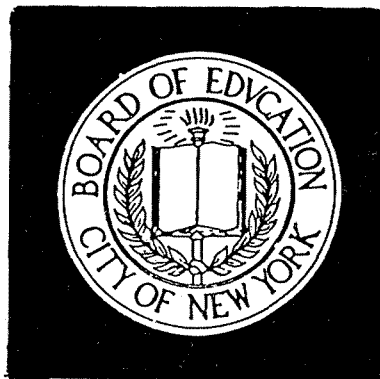


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HEATING, VENTILATING  
AND  
AIR CONDITIONING  
STANDARD SPECIFICATIONS  
THIRTY-FIRST EDITION  
1982



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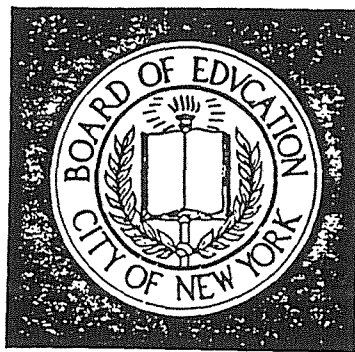
BOARD OF EDUCATION  
CITY OF NEW YORK

DIVISION OF SCHOOL BUILDINGS

28-11 Queens Plaza North  
Long Island City  
New York 11101

HEATING, VENTILATING  
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SECTION 15B-1  
GENERAL CONDITIONS

15B-1.00. Definition

Where the abbreviation "HVAC" appears on the drawings or in the specifications, it shall be understood to mean "Heating, Ventilating and Air Conditioning."

15B-1.01. Numbering of Paragraphs

The numbering of paragraphs is not intended to be consecutive.

15B-1.02. Information

- (a) All information relating to this contract shall be obtained at the Office of the Executive Director.
- (b) No verbal answer will be given to any inquiries in regard to the meaning of the drawings and specifications, nor will any verbal instructions be given previous to the award of the contract. No verbal statement regarding the contract by any persons previous to the award of the contract will be authoritative. Any explanation desired by bidders must be requested in writing. If reply is made, it will be communicated to all Contractors who have indicated their intention to bid on the work.
- (c) Should any errors, omissions, inconsistencies or obscurity in wording appear or occur on the drawings or in the specifications, or should there be any discrepancies between drawings and specifications, the Contractor shall, before submitting his bid apply to the Executive Director, in writing, for an interpretation and determination of the intent of the drawings and specifications. Any interpretation made by the Executive Director previous to the receipt of bids shall be a part of the contract.

15B-1.03. Contract

The attention of bidders is expressly called to the current edition of the contract form which will form a part of this Contract, a copy of which may be examined at Estimating Room 606, 28-11 Queens Place North, Long Island City, N.Y. 11101.



15B-1.04. Scope and Interpretation

- (a) It is the intention that these specifications and the drawings accompanying them shall provide for the furnishing and installing of heating, ventilating and air conditioning equipment, etc., complete as specified and shown. Any work shown on the drawings and not particularly described in the specifications, or vice versa, or any work which may be necessary to complete the contract shall be furnished by the Contractor as a part of his contract.
- (b) During the course of the work should any ambiguities or discrepancies be found on the drawings or in the specifications, or should there be found any discrepancies between the drawings and the specifications, to which the Contractor has failed to call attention before submitting his bid, then the Executive Director will interpret the intent of the drawings and specifications, and the Contractor hereby agrees to abide by the Executive Director's interpretation and agrees to carry out the work in accordance with the decision of the Executive Director. It is expressly stipulated that neither the drawings nor the specifications shall take precedence one over the other, and it is further stipulated that the Executive Director may interpret or construe the drawings and specifications so as to secure in all cases the most substantial and complete performance of the work as is most consistent with the needs and requirements of the work, and of that question the Executive Director shall be the sole judge.

15B-1.05. Examination of Site and Premises

The Contractor shall be held to have examined the site and premises and to have compared it with the drawings and specifications, and to have satisfied himself of the conditions existing at the site and premises, as relating to the actual condition of the site at the time of estimating upon the work, the storage and handling of materials, and all other matters as may be incidental to the work under the contract, before the delivery of his proposal, and no allowance will subsequently be made to the Contractor by reason of any error on his part, due to his neglect to comply with the requirements of this clause.

15B-1.06. Insurance

See the Contract form for Insurance. Fire Insurance shall become effective when the form work for the erection of first floor slabs has been erected. The minimum amount of insurance required by Article 40(4) of the contract shall be:

Public Liability.....\$300,000/\$1,000,000  
Property Damage.....\$100,000/\$250,000

15B-1.07. Compensation and Labor Laws

- (a) The Contractor shall comply with the provision of Chapter 615 of the Laws of 1922, known as the Workmen's Compensation Law, and acts amendatory thereof; also with the provision of the N.Y. State Labor Law; each as respectively provided for in the Contract.
- (b) A copy of wage rates, certified by the Comptroller within 90 days of date of bid opening, is made a part of this specification by attachment.
- (c) The Contractor and every sub-contractor shall post in a prominent and accessible place on the site of the work, a legible statement of wage rates specified to be paid for the various classes of mechanics, workmen or laborers of the work.

15B-1.08. Safety

- (a) Laws, Codes, Provisions; Comply with:
  - 1. Chapter 615, Laws of 1922, Workmen's Compensation Law and all acts amendatory thereof;
  - 2. Industrial Code - Rule 21 and 23, State of New York Department of Labor; and
  - 3. Article 29, Contract Form.
  - 4. OSHA of 1970 and the Construction Safety Act of 1969 as amended.
- (b) First Aid:
  - 1. Provide, at site, kit of articles and medications for supplying first-aid treatment to anyone injured in connection with the work.
  - 2. Make kit available for use by other Contractors working on the site.
- (c) Reports of Accidents and Claims:
  - 1. Submit promptly, on printed forms supplied by Executive Director, reports of all accidents arising out of performance of contract work.
  - 2. Furnish full details, including statements of witnesses, if any.
  - 3. Report immediately, by telephone or messenger, to Executive Director and his job representative, all accidents resulting in death, serious personal injury or serious property damage. Follow-up with written report, as in (1) and (2) above.

15B-1.08. Safety--(Cont.)

4. If any claim is made against Contractor or any sub-contractor as the result of any accident, the Contractor shall submit the facts in written report, giving full details of claim.

15B-1.09. Patented or Particular Articles or Materials

- (a) Whenever any article or class of materials is specified by the trade name or the name of any particular patentee, manufacturer, or dealer, or by reference to the catalog of any such manufacturer or dealer, it shall be taken as intending to mean and specify the article or class of materials specified or any other equal thereto in quality, finish and durability, and equally as serviceable for the purpose for which it is intended as may be judged and determined by the Executive Director.
- (b) Should the Contractor submit and the Executive Director approve, under the provisions of the preceding paragraph, any article or class of materials other than that herein specified as equal in quality, finish and durability and equally as serviceable for the purpose for which it is intended, then the Contractor shall repair, at his own expense, any defects which may develop in the article or class of materials substituted at any time within one year after the completion and acceptance of the entire work called for in this contract and these specifications.
- (c) Should the Contractor submit any article or class of materials other than the one herein specified, as being equal in all respects to and equally as serviceable for the purpose for which it is intended, he shall produce satisfactory evidence that a complete installation of the type of article or material, that he proposes to use, now is and has been in successful operation in or near the City of New York for a period of at least one year.
- (d) Any substitution proposed by the Contractor shall be submitted by him to the Executive Director within two weeks after the award of the contract. Drawings and specifications clearly showing and describing the article or material shall accompany the request for permission to make the substitution. If permission is given, the payment for such article or material will not be made unless and until such article or material, as a whole has been in operation or in use in the building and has proved entirely satisfactory to the Executive Director. In case that the substituted

15B-1.09. Patented or Particular Articles or Materials--(Cont.)

article or material proves unsatisfactory after its installation and is therefore rejected, it shall not be removed from its location in the building or on the premises, until other suitable and satisfactory article or material is installed immediately upon the removal of the rejected article or material.

- (e) No extension of time will be allowed for the time required for the consideration of any article or material thus substituted by the Contractor; neither will any extension of time be allowed or any responsibility be assumed by the Board of Education when a Contractor submits a request for changes in articles or materials or form of construction from that shown or specified, whether such request be granted or denied.
- (f) Whenever specifications identify materials by reference to the names of products of more than one manufacturer and whenever specifications give optional methods or materials, the choice shall be made by the Contractor. No change in contract price shall be involved in any decision by the Contractor in using any of these optional materials and methods.
- (g) Nothing in these specifications shall be interpreted or taken to violate the provisions of Chapter 13, Par. 348 of the New York City Charter, which provides that:

"except for repairs, no patented pavement shall be laid, and no patented article shall be advertised for, contracted for or purchased, except under such circumstances that there can be a fair and reasonable opportunity for competition, the conditions to secure which shall be prescribed by the Board of Estimate unless the Board of Estimate by a three-fourths vote shall find that it is to the interest of the City in a particular case to purchase and shall authorize the purchase of a patented article as to which competition cannot be secured."

15B-1.10. Ordinances, Permits, Fees, Etc.

- (a) All necessary permits from the municipal or other public authorities shall be secured by and at the cost and expense of the Contractor who shall give all notices required by law, municipal ordinances, or the rules and regulations of the various Municipal Bureaus or Departments, and also as a part of the contract, and, without extra charge or compensation, shall comply with all State laws and all municipal Ordinances or Regulations that may be applicable to this work, together with all

15B-1.10. Ordinances, Permits, Fees, Etc.-(Cont.)

orders of the Department of Buildings, Department of Health, Department of Water Resources, Bureau of Gas and Electricity, Fire Department, Department of Air Resources, Department of Highways, etc., which shall be issued (in compliance with ordinances or regulations existing at the time bids are presented) by any or all of said Departments as applying to the work of the contract. See also Paragraphs 15B-7.00(b), 15B-17.24 and 15B-18.06.

Note: Wherever in these specifications the name of a city official, bureau or department is mentioned, it is intended to mean the official, bureau or department having jurisdiction under the New York City Charter and the Code of Ordinances.

- (b) Attention is called to certain provisions of the Building Code, regarding support of walls adjoining excavations, sidewalk sheds, scaffolding, roofs of adjoining buildings, floors to be filled in or covered, protection of floor openings, overloading, chimneys to be carried up, etc., which provisions shall be complied with.
- (c) The Contractor shall deliver to the Executive Director all permits, including equipment use permits, or certificates of approval issued by the Department of Buildings, Department of Health, Department of Water Resources, Bureau of Gas and Electricity, Fire Department, Department of Air Resources, Department of Highways, and other departments having jurisdiction in connection with this work, before the certificate for the final payment is issued.
- (d) Controlled Inspection
  - 1. Contractor's attention is directed to the requirement of the Building Code relative to the controlled inspection of certain types of service equipment. This equipment includes air conditioning and ventilating systems, fuel burning and fuel storage equipment, refrigeration systems, the welding of steel pipe in high pressure steam piping systems, and heating systems. The controlled inspection shall be made by or under the direct supervision of an architect or engineer. For this purpose, the Contractor shall, as part of the work of the contract, provide the services of a competent licensed engineer or architect who is not directly employed by the Contractor and is not receiving benefits affiliating him with the firm. The Contractor shall submit the name/s of the Engineer or Architect engaged, for the approval of the Executive Director. Contractor's attention is also directed to Sub-Article 1208 of the Building Code relating to noise control.

15B-1.10. Ordinances, Permits, Fees, Etc.-(Cont.)

2. The architect or engineer employed by this Contractor shall be responsible for filing all initial amendments, properly executed before the work commences, and all final amendments immediately upon completion of the work. A copy of each approved amendment shall be forwarded to the Bureau of Construction. Initial amendments must be on file before work commences and final amendments must be on file before final acceptance of the work.
3. Contractor must notify the architect or engineer designated for controlled inspection, in writing, 72 hours before the specific work item commences. Thereafter, it shall be the responsibility of the architect or engineer to keep up with the progress of the work.
4. Inspections and tests performed under controlled inspection shall in no way relieve the Contractor of his responsibility to construct in accordance with drawings and specifications and the Contractor expressly understands that there is no warranty given by the Board of Education to the Contractor in connection with such inspections and/or tests or certifications made under controlled inspection.

15B-1.11. Warranty Money

- (a) A sum of money equal to the percentage of the contract price (less the amount for temporary heat labor) as listed in the schedule below shall be deposited by the Contractor with the Executive Director in cash or certified check upon a state or national bank and trust company or a check of such bank and trust company signed by a duly authorized officer thereof and drawn to the order of the Comptroller; or obligations of the City of New York, which the Comptroller may approve of as equal value with the sum so required, for a period of not less than one calendar year from the date as defined in Article 70 of the Contract.

In lieu of the above, the Contractor may make such security payment to the Board by authorizing the Executive Director in writing to deduct the amount from the final payment which shall be deemed the deposit required above. This deposited sum of money will be held as security for the performance by the Contractor of any and all work of his contract that may be found within the stated period, to have been improperly performed or to be incomplete and for replacing and making good of any work or material that is found to be defective or that has unduly deteriorated during the stated period; all as judged and determined by the Executive Director.

15B-1.11. Warranty Money-(Cont.)

The percentage of the contract to be deposited, based on the amount of the contract, shall be as follows:

\$50,000 and less . . . . .	1.00%
\$50,000 to \$750,000. . . . .	0.75%
\$750,000 to \$1,250,000. . . . .	0.60%
\$1,250,000 to \$2,000,000. . . . .	0.50%

The minimum to be deposited, regardless of the above, shall be One Hundred Dollars (\$100.00).

- (b) If any such work as aforesaid is discovered within the stated period then the Contractor shall, within three days after notice from the Executive Director, commence to remove all defective and deteriorated work and material and to replace it with work and material in accordance with the requirements of the specification and shall complete all uncompleted work as required by the specification and shall finish this work within reasonable time.
- (c) In the event of the failure of the Contractor to begin the aforesaid work within three days and to complete the work within a reasonable time thereafter, then the Executive Director will cause such work to be done by other parties and deduct the cost thereof from the deposited percentage.
- (d) The deposited percentage or any balance thereof that may be left after the payment has been made for making good defective or deteriorated work or completing uncompleted work of the contract that has been done by other parties, will be paid to the Contractor after the expiration of the stated period of one calendar year upon the certificate of the Executive Director which will state the amount of the balance due to the Contractor.

15B-1.12. Checking, Changes of Grades and Lines

Levels shall be taken from the legally established grades as shown on the survey. In order to provide for possible changes in the street lines and grades as between those shown by the plans and the date when curb is set, or sidewalk laid, or fence on street fronts erected, the Contractor, just prior to the beginning of such work, or any part thereof, shall consult the records of the Topographical Bureau of the Borough in which the building is located. Should it transpire that any changes in grades or lines have been made or are contemplated, the Contractor shall immediately notify the Executive Director, in writing, that

15B-1.12. Checking, Changes of Grades and Lines-(Cont.)

he may make the necessary adjustment in the drawings. Failure on the part of the Contractor to comply with this requirement will place upon him the responsibility and expense of making any changes in curbs, sidewalks, fences or other work that may be necessary, to comply with the changed conditions.

15B-1.13. Axis Lines and Levels

The Contractor for General Construction will provide and maintain legible axis lines and level markings for the use of his sub-contractors and other contractors. There will be two axis lines for each rectangle or wing of the building plan. These axis lines will be provided soon after excavation work commences. They will be provided on the forms for each floor before concrete is poured; they will again be provided after the concrete is poured, and will be maintained until partitions are commenced. Level markings will be provided on at least 80% of the columns above each floor. They will be placed four (4) feet above the finished floor level. The Contractor for General Construction will be responsible for the accuracy of axis lines and level markings. He will provide proper surveying equipment and personnel to establish them.

15B-1.14. Guarantees

- (a) The Contractor shall guarantee that all work of this contract is free from defects, and is as specified. Should any defects, which cannot be proven to have been caused by improper use, develop within the space of one year from the date of completion of the work, as certified by the Executive Director in his certificate for final payment, such defects shall be made good by the Contractor, free of cost to the Board of Education.
- (b) Contractor's attention is directed to Par. 15B-17.15 regarding temperature control and to Par. 15B-21.00 regarding refrigeration equipment, for which longer guarantee periods are specified.

15B-1.15. Drawings and Specifications

- (a) The drawings included in this contract are listed in the AMENDMENTS, grouped as follows:
  - 1. Project Drawings. (sometimes referred to as the working set).
  - 2. Standard Details. These contain details of certain work required by the specification and drawings.
  - 3. Supplementary Drawings. These may be issued by the Executive Director in accordance with the contract, after the contract is awarded, in order to illustrate further the work required by the contract.



15B-1.15. Drawings and Specifications-(Cont.)

- (b) Whenever the words "Drawings" or "Plans" are used in the specifications, they shall be taken to include all of the drawings listed above. The word, "details" shall mean any details appearing on any drawing listed above.
- (c) The drawings issued to prospective bidders will consist of Project Drawings (a)1. Standard Details (a)2 will not be issued to intending bidders unless separate purchase is made. These Standard Details will be on file for examination in the Estimating Room, 28-11 Queens Plaza North, Long Island City, N.Y. 11101. Each prospective bidder shall avail himself of the plans and specifications of all other trades, making himself aware of items affecting his work.
- (d) Upon award of the contract, the Executive Director will issue to the Contractor:
  - 6 sets of specifications  
(in addition to the one signed contract set)
  - 6 print sets of drawings (one set on cloth)  
of project drawings (a) 1
  - 3 print sets of standard details (a) 2The Contractor will also be given one set of specifications and one set of contract drawings of each of the other trades.
- (e) All drawings and specifications issued to the Contractor are the property of the Board of Education. They shall at all times be subject to the control of the Executive Director and at the completion of the contract shall be returned upon request. Specifications and drawings, including the signed set and those issued or purchased, shall be used only in connection with this contract and they shall not be used for any other purpose without written authorization from the Executive Director.
- (f) Specifications (if a supply is available) and prints of further drawings required by the Contractor may be purchased by the Contractor at the rates set forth in the Instructions to Bidders.
- (g) The drawings and specifications shall be carefully examined by the Contractor for the purpose of ascertaining whether or not they have the necessary scale drawings and details for all work shown, indicated or called for. Failure to apply at the proper time for details of any work so indicated shall

15B-1.15. Drawings and Specifications-(Cont.)

not release the Contractor from furnishing said work, or from responsibility for the loss of time, or from constructing same in accordance with details.

- (h) This Contractor shall, at his own cost and expense, secure from the Division of School Buildings, transparencies of the Project drawings for HVAC work. The Contractor shall furnish "As-Built Drawings" that consist of all field changes involving construction materials, equipment and other items that are made or installed differently than indicated or called for in the Contract Drawings and Specifications. These drawings shall also include changes that were required or approved by the Executive Director. As-Built Drawings shall be updated and reviewed monthly with the Bureau of Construction field representative. At the completion of the work of this Contract, the finished "As-Built Drawings" transparencies shall be delivered to the Executive Director together with the application for final payment. "As-Built Drawings" are not required for modernization or alteration projects.

15B-1.16. Checking

The Contractor shall check the figures and dimensions on the drawings and shall notify the Executive Director of any discrepancies which require his attention. The Contractor will be held responsible for any errors not discovered before the work has been executed, but he shall not alter specifications, drawings, or figures, nor make alterations in or additions to the quantity, character or arrangement of the materials or work whether same shall involve additional expense or not, unless it shall be agreed upon first in writing, as provided for by the contract; this provision, however, shall not abridge in any way the Executive Director's rights as to the interpretation of the specifications, drawings and figures thereon.

15B-1.17. Shop Drawings

- (a) The Contractor shall promptly prepare and submit all shop drawings required by the specifications, contract and contract drawings, also all incidental shop drawings required for the proper performance of the work. The shop drawings shall illustrate fully the requirements of the specifications and the contract drawings, and shall accurately show quantities, kind of materials, method of assembly and all data required for fabrication, erection and installation. The relationship to adjoining work, whether furnished under other subdivisions of this contract or by other contractors, shall be properly shown.

15B-1.17. Shop Drawings-(Cont.)

- (b) Shop drawings shall be identified by numbers, title, and school, and shall be bound in sets. The submission of shop drawings shall be accompanied by letter, in duplicate, from Contractor, giving the titles and numbers of drawings. Where printed material, bulletins, illustrations, and other data are submitted for approval, they shall conform to the requirements for shop drawings.
- (c) The Contractor shall furnish four (4) sets of shop drawings with a letter of transmittal to the Bureau of Construction for a project designed by the Bureau of Design or the Bureau of Modernization; he shall furnish six (6) sets of shop drawings with a letter of transmittal to the Private Engineer for a project designed by the Private Engineer. Two (2) sets of approved shop drawings will be returned to the Contractor. Should the Contractor require more sets of the approved shop drawings for his own use, or if copies of such drawings be required by other City Agencies having jurisdiction over the work, or if copies are required by other Contractors whose work is related thereto, such additional copies shall be furnished by the Contractor at his own expense. When motor data, etc., requiring approval by the Bureau of Gas and Electricity are submitted for approval, five (5) sets of such data shall be submitted.
- (d) If the shop drawings are disapproved for failure to comply with contract requirements, or for other corrections, one (1) copy will be mailed to the Contractor with the corrections noted. The Contractor shall promptly make such corrections and changes, and again submit the number of sets as stated in (c), for final approval. No claim for delays, caused by the disapproval of drawings submitted, will be allowed if such disapproval is based on non-compliance with, or any deviation from, the contract requirements.
- (e) The submission of shop drawings (in either the original submission or resubmitted with corrections) constitutes evidence that the Contractor has checked all information thereon, and that he accepts and is willing to perform the work as shown, in a workman-like manner and in accordance with the best standard practice. No claim for extra shall be based on work shown on a shop drawing, unless such claim is so noted on the Contractor's transmittal letter accompanying the shop drawings.

15B-1.17. Shop Drawings-(Cont.)

- (f) The approval of shop drawings will be general and shall not in any way relieve the Contractor from responsibility for the proper fitting, finishing and erection of the work in strict accordance with the contract requirements, nor does it relieve him from the responsibility of furnishing materials and workmanship not indicated on approved shop drawings but required for the completion of his work.
- (g) No work requiring submission of shop drawings shall be commenced until shop drawings are approved.

15B-1.18. Gauges

Wherever thickness of metals are designated on the drawings or in the specifications by gauge number, and the type of gauge, or thickness in decimals of an inch, is not stated, the following gauges shall apply:

Material	Sheets	Wire	Seamless Tubing
Steel & Iron	U.S. Standard	Steel Wire or Wash & Moen	Birm.Wire or Stubs Iron
Stainless Steel	"	"	"
Copper	Oz. per sq.ft.	Amer.Wire Or B. & S.	"
Brass	Amer. Wire or B. & S.	"	*BirmWire or Stubs Iron
Bronze	"	"	.....
Monel	U.S. Standard	"	Birm. Wire or Stubs Iron
Aluminum	Amer. Wire or B. & S.	"	"
Zinc	Zinc	.....	.....

\*Shall be B.&S. gauge if so specified.

15B-1.19. Samples

- (a) The Contractor shall furnish for approval by the Executive Director such samples as are hereinafter specified. In addition, in cases where material and quantity are not definitely specified, samples or specimens shall be submitted for approval. Neither experimental nor untried types of construction, materials, devices, apparatus, etc. will be accepted. The work shall be in accordance with approved samples.

15B-1.19. Samples-(Cont.)

- (b) To insure prompt consideration of samples, Contractor shall mail a letter on the date of shipment, containing a list of samples that have been forwarded, together with the brand and the name of the manufacturer of the materials. This letter must not be sent in the same package with the samples. Any sample received in advance of such letter will be held two weeks; if at the expiration of that period no identifying letter has been received, the package will be given no consideration and will be discarded.
- (c) All samples must be carefully packed so as to insure their delivery in good condition. Each sample must have a label showing the material represented, the name of the Contractor, the name of the manufacturer of the material, and the name or number of the school and its location for which the sample is intended.
- (d) The approval of samples is for quality, color and finish generally and does not modify the requirements of the specification or drawings as to dimensions or design.
- (e) Samples shall be submitted in duplicate, one for the Executive Director's Office files and one for forwarding to the building. Should the Contractor desire an approved sample for his own files an additional sample shall be submitted; this sample shall be removed by the Contractor from the office of the Executive Director within ten days after approval.
- (f) The approval of samples will be general and will not modify the requirements of the contract nor relieve the Contractor of any responsibility therewith. Approval will be limited to certain qualities (such as color only, finish only, construction only, etc.) wherever applicable and all other features shall be in accordance with specification requirements.

15B-1.20. Materials, Labor, Tools, Etc.

- (a) See Contract Form in regard to labor, tools, scaffolding, etc.
- (b) All materials and equipment shall be new and as specified.
- (c) The workmanship and materials of all items shall be of the best quality and shall at all times be subject to the inspection, direction and supervision of the

15B-1.20. Materials, Labor, Tools, Etc.--(Cont.)

Executive Director, who shall be afforded facilities for inspecting all parts of the work, and who may reject all workmanship and materials which do not conform with the intent of the drawings and specifications. All such condemned work or materials, shall be removed forthwith and immediately replaced with proper and acceptable work and materials. Failure to exercise such power, however, shall not be construed or held by the Contractor as an admission on the part of the Executive Director that the work, or any part thereof, has been faithfully performed in case the fact shall be otherwise.

15B-1.21. Machinery List

The Contractor shall accompany the application for final payment with a list, in duplicate, properly filled in, on printed form issued upon application therefor at the office of the Executive Director, stating the makes, sizes, type, and operating speeds, etc., of all machinery, apparatus and specialties installed by him in this work.

15B-1.22. Re-Examination and Covering Up of Work

Re-examination of questioned Work may be ordered by the Executive Director, and if so ordered, such part of the Work must be uncovered by the Contractor. If such part of the Work be found in accordance with the Contract Documents, the Executive Director shall pay the cost of re-examination and replacement. If such part of the work be found not in accordance with the Contract Documents, the Contractor shall pay such cost and also the cost of restoring the work of any other contractor damaged or removed. If any part of the work of the Contractor or of any other contractor be covered up by the Contractor without approval or consent of the Executive Director, such work must, upon request of the Executive Director, be uncovered and restored to the satisfaction of the Executive Director at the expense of the Contractor.

15B-1.23. Time for Beginning and Completing Work

- (a) The starting date of this contract shall be three days from the date of the notice by the Secretary of the Board of Education to the Contractor, that the Comptroller has attached his certificate of the appropriation of funds to the contract, and the period fixed for the completion of the work, stated in Amendment No. 1, shall begin to run from said commencement date.

15B-1.23. Time for Beginning and Completing Work-(Cont.)

- (b) For completion of the contract and consequent release of responsibility and final payment approval, the word "completion" shall mean full and exact compliance and conformity with the provisions and requirements, expressed or implied, in this specification and the drawings accompanying and forming part of the same, including all amendments, revisions, corrections or additions, duly authorized. "Substantial completion" (re liquidated damages) shall be as defined in the contract. Liquidated damages required under Article 17 of the contract, for each day's delay, shall be in the amount per day stated in (f).
- (c) It is required that the Contractor shall have the gymnasium completed sixty (60) consecutive calendar days before the contract expiration date so that it will be available for storage of furniture. The Board may then occupy same under the conditions of Article 7 and Article 70 of the Contract. Minor work in gymnasium may be performed during furniture storage. Enclosing doors which can be locked from passage, corridors, etc., will be completely installed and locked to make ready for furniture delivery and storage.
- Note: It is not mandatory that the permanent heating, ventilating and air conditioning work be in operation sixty (60) consecutive calendar days before contract expiration date, but the work of installing heating, ventilating and air conditioning work in the gymnasium must be completed sixty (60) consecutive calendar days before contract expiration date.
- (d) The time allowed to complete the whole work will be as stated in the Amendments.
- (e) Any extension of time granted to the General Construction Contractor due to the delay of the work of his contract caused by the failure of the HVAC Contractor to progress the work in accordance with the terms of his contract, shall not apply to the HVAC Contractor if he is responsible for such delay.
- (f) Liquidated Damages, as defined in Article 17 of the contract for delay in completing the work shall be in the amount per day as stated below:

15B1.23. Time for Beginning and Completing Work-(Cont.)

Liquidated Damages	Amount of Contract
\$ 5.00 per day on contracts up to	\$ 2,500.00 inclusive
8.00 per day on contracts from	2,500.01 to \$ 5,000 incl.
11.00 per day on contracts from	5,000.01 to 9,000 incl.
15.00 per day on contracts from	9,000.01 to 13,000 incl.
20.00 per day on contracts from	13,000.01 to 18,000 incl.
25.00 per day on contracts from	18,000.01 to 23,000 incl.
30.00 per day on contracts from	23,000.01 to 30,000 incl.
38.00 per day on contracts from	30,000.01 to 40,000 incl.
45.00 per day on contracts from	40,000.01 to 80,000 incl.
68.00 per day on contracts from	80,000.01 to 120,000 incl.
85.00 per day on contracts from	120,000.01 to 160,000 incl.
98.00 per day on contracts from	160,000.01 to 220,000 incl.
113.00 per day on contracts from	220,000.01 to 280,000 incl.
128.00 per day on contracts from	280,000.01 to 340,000 incl.
143.00 per day on contracts from	340,000.01 to 420,000 incl.
158.00 per day on contracts from	420,000.01 to 500,000 incl.
185.00 per day on contracts from	500,000.01 to 750,000 incl.
210.00 per day on contracts from	750,000.01 to 1,000,000 incl.
260.00 per day on contracts from	1,000,000.01 to 1,500,000 incl.
310.00 per day on contracts from	1,500,000.01 to 2,000,000 incl.

15B-1.24. Job Progress Chart

As soon as is practicable after the award of the contract, the Contractor for General Construction will furnish for approval, a Job Progress Chart indicating graphically the time the various parts of the work of all Contracts will be commenced and completed. Chart shall be similar to chart on display in the office of the Executive Director and shall consist generally of chart in reproducible form and showing:

Primary and Intermediate	High Schools	Contract
Approximately 60 items	70 items	General Construction
Approximately 30 items	40 items	Plumbing and Drainage
Approximately 30 items	40 items	Heating, Ventilating, and Air Conditioning
Approximately 30 items	40 items	Electric Work and Lighting Fixtures

Contractors for Plumbing and Drainage, for Heating, Ventilating and Air Conditioning for Electric Work and Lighting Fixtures are required to furnish data and to cooperate in formulating the Chart. After approval of the Chart by the Executive Director it shall be the duty of the HVAC Contractor and all other Contractors to consult such Progress Chart and to arrange their work in such manner that it will be installed within the limits indicated on the Chart. The Chart thereafter may be modified only with permission of the Executive Director. In the event of substantial delay, excusable under the Contract, for which extension of time (Cont.)



15B-1.24. Job Progress Chart-(Cont.)

has or will be granted, the General Construction Contractor shall review and revise the Chart as required by the Situation with the cooperation of the Contractors for Plumbing and Drainage, Heating, Ventilating and Air Conditioning, Electric Work and Lighting Fixtures.

INSTRUCTIONS

RE: COORDINATED JOB PROGRESS CHART

- Step 1. Each prime contractor prepares preliminary and tentative job progress schedule indicating the start and finish of the various items of his work. List items in proposed chronological order, numbered consecutively, using a suffix to identify each contract:
- General Construction.....1G,2G,3G; etc.  
Plumbing & Drainage.....1P,2P,3P; etc.  
HVAC.....1H,2H,3H; etc.  
Electric Work & Lighting Fixtures...1E,2E,3E; etc.
- Subdivide the items whenever required in order to coincide exactly with the proposed sequence and timing of operations in the field. Each contractor shall arrange schedule of items to suit requirements of this particular project. Each mechanical contractor submits his list to the General Contractor.
- Step 2. General Contractor prepares composite job progress chart on reproducible blank forms furnished by the Executive Director. Chart shall indicate graphically, and chronologically arranged, the time the various parts of the work of all contracts shall be commenced and completed.
- Step 3. General Contractor meets with the Mechanical Contractors, discusses the schedule of items, makes adjustments and coordinates the requirements of all contracts.
- Step 4. General Contractor prepares the master "Coordinated Job Progress Chart" which must then be signed and dated by each prime contractor or his official representative, and finally by the Executive Director.

15B-1.24. Coordination and Expediting-(Cont.)

Step 5. In the event of substantial delay, excusable under the contract. for which extension of time has or will be granted, the General Contractor reviews and revises the chart as required by the situation. Mechanical contractors cooperate as in Step 3. Upon the agreement of all contractors, revised chart is signed and dated by each prime contractor or his representative and finally by the Executive Director.

15B-1.25. Schedule of Items and Costs

Immediately following the awarding of contracts, the Executive Director will forward to the Contractor, printed forms in which the various items entering into the work are set forth and for other information required by the Executive Director. These forms shall be set up as a "Schedule of Items and Costs" and filled in by the Contractor with the costs and percentages charged against each of such items, and returned to the Executive Director for his approval three weeks prior to the date the contractor makes application for his first payment. No payment will be made until it is proven that the costs charged against each item are reasonably correct. The cost and percentage of each item, shown on the schedule, approved by the Executive Director shall be final and conclusive upon the contractor.

15B-1.26. Progress Payments

- (a) As provided by the contract, payments will be made in installments as the work progresses.
- (b) For the purpose of making payments the percentages of the Contract Price for items of work shall be assumed to represent the full value of the items permanently in place and include therein payments for all work incidental thereto or required for their performance otherwise provided for in "Schedule of Items and Costs". All items of work not specifically listed in the schedule but required for the performance of the contract shall be construed as incidental and paid for without other provision for payment than provided. Should a question arise as to the value of any subdivision of the work included within any item, or what work is paid for by any percentage of the contract price, the Executive Director shall decide same. The percentages of the contract price shall be computed to the nearest full dollar as indicated on the estimate sheet.

15B-1.26. Progress Payments-(Cont.)

- (c) The Contractor shall make application in writing to the Executive Director for progress or final payments on forms furnished him, submitting thereon an accurate estimate in detail showing the value of the work completed in each stated item, and moneys earned in the payment itself. Five signed copies of the payment application must be submitted. All applications for payments, except for final payment, shall be submitted as specified in the Amendments, otherwise applications will be disregarded until the following monthly period.
- (d) Monthly applications for progress payments shall include the certificate of the Contractor stating the hourly period each day during which temporary heat was furnished, and that the labor assigned to temporary heat was not utilized for work other than that attributable to temporary heat duty.
- (e) The basis for determination of the amount to be deposited as Warranty Money on Progress payments shall be the contract price, excluding the sum designated for the payment for labor for furnishing temporary heat.

15B-1.27. Time Statement

The Contractor must file with the Executive Director at the end of each month a detailed statement of time lost, if any, with the cause thereof, during the current month; otherwise no extension or allowance of time on contract will be considered.

15B-1.28. Work During School Sessions

- (a) If, through fault or delay on the part of the Contractor, it becomes necessary, in the opinion of the Executive Director, to carry out any portion of the work after the building is occupied, it must be done at such times and in such manner as not to disturb or interfere with the school sessions. Also see Paragraph 16-1.40.
- (b) The yards, pupils' toilets, playrooms, passageways, stairways and exits shall be kept clean and unobstructed at all times.

15B-1.29. Co-operation with Other Contractors

- (a) Inasmuch as the completion of the building within the prescribed limit of time is dependent very largely upon the close and active co-operation of all those engaged therein, it is therefore expressly understood and agreed that the Contractor shall lay out and install his work at such times and in such manner as not to delay or interfere with the carrying forward of the work of the Contractors for General Construction, Plumbing and Drainage, and Electric Work.
- (b) It is further agreed that in the event of any dispute arising as to possible or alleged interference between the various Contractors which may retard the progress of the work, the dispute shall be adjusted by the Executive Director, whose decision as to the party or parties at fault, and as to the manner in which the matter may be adjusted, shall be binding and conclusive on all parties.

15B-1.30. Composite Drawings

- (a) Contractor for Heating, Ventilating and Air Conditioning shall be responsible for coordinating the installation work of all the mechanical contractors (HVAC, Plumbing and Drainage, and Electric Work) by means of composite drawings, as specified herein. Contractor shall include in his bid the cost of this coordination, and shall indicate this cost as a separate item, "Composite Drawings", on the "Schedule of Items and Costs". Composite drawings shall be completed in time so as not to delay the installation of any floor slab in which the placing of mechanical equipment (sleeves, inserts, conduits, etc.) is involved.
- (b) The composite drawings shall be constituted in the following manner: HVAC Contractor shall prepare a set of sepia transparencies drawn to the scale of  $3/8" = 1'-0"$ , indicating thereon all ductwork, steam and return piping, hot and/or chilled water piping and sprinkler work, plus structural and architectural background details. He shall deliver this set of sepias to the Contractor for Plumbing and Drainage, who will draw his work to scale on the sepias. Then the HVAC Contractor shall deliver the set of sepias to the Contractor for Electric Work, who will superimpose his work on the drawings. The specified order in which the Contractors impose their work on the sepias is not intended to grant priority to any one Contractor in the allocation of space. At the completion of this phase, the HVAC Contractor shall hold a coordination meeting with the two other mechanical

15B-1.30. Composite Drawings-(Cont.)

contractors to eliminate any interference among the trades that the drawings indicate and to avoid any conflicts in installing the work. Prior notice of the coordination meeting shall be given to the Executive Director so that his representative will be present to assist in the resolution of conflicts. The Contractor for General Construction shall also be notified of the time and place of the coordination meeting. If the Contractors are unable to reach agreement on a matter of interference among the mechanical trades, the matter shall be submitted to the Executive Director for his binding decision. Should any problems of coordination require architectural or structural change of design, this change shall be submitted to the Executive Director for approval. After the set of sepias has been coordinated and all necessary changes have been made, each mechanical contractor shall sign the drawings, attesting to his agreement that all work is clear.

- (c) When the composite drawings have been completed and signed by all mechanical contractors, the HVAC Contractor shall submit nine (9) copies to the Executive Director for distribution. Distribution will be made as follows:

- Board of Education.....3 copies
- Electrical Contractor.....2 copies
- Plumbing and Drainage Contractor.....2 copies
- General Construction Contractor.....2 copies

- (d) Receipt and distribution of the composite drawings by the Executive Director does not relieve the Contractor of his responsibility to furnish and install completely the various systems and their accessories as specified and as required by the contract drawings.
- (e) Composite drawings are not required for modernization or alteration projects.

15B-1.31. Job Meetings

- (a) The Contractor or his Superintendent and (in the opinion of the Executive Director) and sub-contractors, material men, or vendors, whose presence is necessary must attend meetings (referred to as job meetings), when called by the Executive Director or his representative for the purpose of discussing the execution of the work. Each of such meetings will be held at the

15B-1.31. Job Meetings-(Cont.)

time and place designated by the Executive Director or his representative. All decisions, instructions, and interpretations given by the Executive Director or his representative at these meetings shall be binding and conclusive on the Contractor. The proceedings of these meetings will be recorded and the Contractor will be furnished a reasonable number of copies for his use and for distribution to the various sub-contractors, material men and vendors involved.

- (b) Job Meetings may also be called by the General Construction Contractor for the purpose of expediting and scheduling the work of all Contracts; and other Contractors and their sub-contractors, material men or vendors whose presence is necessary are required to attend. These meetings may, at the discretion of the General Construction Contractor, be held at the same place and immediately following the Job Meetings called for by the Executive Director.

15B-1.32. Sub-contractors

- (a) The Contractor shall, before subletting any portion of the work or materials of this contract, submit to the Executive Director for his approval, the name of each concern or individual to whom he proposes to sublet any part of the work or material. He shall not sublet any part of the work or material to any concern or individual until the Executive Director has approved in writing the subletting of that part of the work or material to such concern or individual.
- (b) Nothing contained herein shall in any way lessen the responsibility of the Contractor to secure as sub-contractors, firms, concerns, or individuals of good standing in their respective lines, who shall be required to comply with all drawings, specifications and instructions of the Executive Director and with all general and special conditions of the contract, precisely the same as the Contractor himself. All transactions with such parties shall be made through the Contractor unless he shall, in writing, sanction that they may confer with the Executive Director, but this, however, shall not release the Contractor from full responsibility therefor.

15B-1.33. Contractor's Superintendent

- (a) The Contractor must devote his time and personal attention to the work, and shall employ and retain at the building from the commencement until the entire completion of the work, a Contractor's superintendent, competent and capable of maintaining proper supervision and care of the work. The Contractor's superintendent shall be acceptable to the Executive Director, and, in the absence of the Contractor and irrespective of any superintendent or foreman employed by any sub-contractor, shall see that the instructions of the Executive Director are fulfilled.
- (b) The Contractor's superintendent on the job shall not be changed or removed without the consent of the Executive Director unless the Contractor's superintendent proves to be unsatisfactory.

15B-1.34. Responsibility, Watchman, Lights, etc.

- (a) The Contractor shall assume all responsibility for his work and materials until the final completion and acceptance of his work and shall, without extra cost to the Board of Education, replace and make good any of his work or materials which may be stolen or damaged prior to the acceptance of the work.
- (b) The watchman or watchmen required under the contract for General Construction shall not be responsible for materials or work of this contract. If the Contractor, in order to protect his materials and work as specified in Par. (a), requires the services of a watchman or watchmen, he shall supply such without additional cost as part of this contract.
- (c) The Contractor shall be responsible for any and all damages which may arise or occur to any party whomsoever by reason of taking down or removing materials on or from the premises, the opening or blocking of streets, excavating for any purpose, or by neglecting to provide proper lights, guards, barriers, or any other safeguards to prevent damage to property or injury to persons.

15B-1.35. Openings, Channels and Cutting

- (a) The Contractor for General Construction will build in the foundation walls, floor and roof slabs, all openings, channels, chases, flues, etc., as required to complete his contract, also such opening, etc., for the HVAC, sanitary, and electric work, or for any other installations not included in the Contract for General Construction. Mechanical Contractors shall furnish to the Contractor for General Construction,

15B-1.35. Openings, Channels and Cutting-(Cont.)

complete detail drawings for openings, channels, chases, etc., required in the foundation walls, floor and roof slabs, in connection with their work. Where channel bucks are required for chases not originally shown on the general construction drawings, such channel bucks shall be furnished and erected by the General Contractor and paid for by the Contractor requiring same.

- (b) The Contractor for General Construction will do all cutting and patching as required to complete the general construction work; cutting, if required by other Contractors, shall be paid for by the contractors requiring same.
- (c) Contractors for Plumbing and Drainage, HVAC, and Electric Work, or for any other installation not included in the general construction work, shall furnish, set and maintain pipe sleeves, inserts, etc., in floor slabs, etc., in connection with their work. Such pipe sleeves, etc., shall be set and information regarding openings shall be furnished in ample time to allow the construction work to proceed without delay. In the event that the HVAC Contractor fails to furnish the foregoing information, he will be required to do cutting and refinishing in connection therewith at his own expense.
- (d) After the installation of such work for which openings, channels, chases, etc., have been provided by the Contractor for General Construction, the Contractor for General Construction will build in, finish over and around all openings, channels, chases, etc., as required to complete the construction contract.
- (e) Openings through exterior foundation walls will be made water-tight by the Contractor for General Construction after pipes, conduits, etc., passing through the walls have been installed by the various equipment contractors. This building is planned and detailed, and it is the intent of these specifications, to provide a structure that will prevent the penetration by rodent vermin of any vacant space where they might find a harborage. The General Contractor will be held responsible for securing this condition by the closing of points of access to such spaces, including the passage of piping and conduits, through walls, partitions, ceilings and furred out spaces, the closing of access to voids in hollow tile or cinder blocks, etc. There shall be a special inspection of the building with regard to this matter before final acceptance.



15B-1.35. Openings, Channels and Cutting-(Cont.)

- (f) Positive instructions shall be obtained in writing from the Executive Director or his representative before cutting, drilling or boring floor beams or other structural members, arches, lintels, etc. Permission shall also be obtained before cutting or drilling light weight concrete blocks.

15B-1.36. Repairing

The HVAC Contractor shall do repairing of work that becomes damaged by his workmen or the workmen of any of his sub-contractors during the progress of his work or prior to its acceptance.

15B-1.37. Permission for Working Overtime

No work shall be done on the job before 8 A.M. nor after 5 P.M. nor shall any work be done on Saturdays, Sundays or legal holidays unless the Contractor shall have given the Executive Director at least 48-hours advance notice in writing.

15B-1.38. Overtime Custodial Services

- (a) Contractors requesting and receiving permission from the Executive Director to perform work in buildings after the building is occupied, on Saturdays, Sundays, Holidays and after the regular hours of duty on business days, shall be required to pay the custodian-engineer, custodian or cleaner-in-charge of such buildings for the duly authorized extra service entailed, compensation in accordance with the following schedule:
- (b) After 5:00 P.M. on business days....\$16.00/hr.-\$16.00 min.
- (c) Saturdays, Sundays & Holidays.....\$16.00/hr.-\$64.00 min.  
For this purpose, Holidays are as follows:  
New Year's Day, Martin L. King Jr.'s Birthday, Lincoln's Birthday, Washington's Birthday, Good Friday, Memorial Day, Independence Day, Labor Day, Rosh Hashanah, Yom Kippur, Columbus Day, Election Day, Veteran's Day, Thanksgiving Day and Christmas Day.
- (d) Before 7:45 A.M. on all regular business days during summer, Christmas and Easter vacation periods.....  
\$16.00/hr. prorated.
- (e) When several Contractors are working at a School at the same time of the day hereinbefore stated, each Contractor shall pay the Custodian-Engineer, Custodian or Cleaner-in-charge his share of fee which will be derived by dividing the Custodian Compensation Fee per hour or Minimum Fee by the number of Contractors.

15B-1.38. Overtime Custodial Services-(Cont.)

at work. Custodian-Engineer, Custodian, or Cleaner-in-charge will keep an hourly record of number of Contractors at work and their names.

- (f) For keeping the schools open for the benefit of Contractors for purposes or in a manner not clearly covered in the foregoing schedule conditions, the Executive Director shall be empowered to apply the most equitable rate or rates.
- (g) Contractor shall not pay the Custodian anything in excess of the above schedule.

15B-1.39. Overtime Work (Ordered by B. of E.)

- (a) The Board of Education can order overtime work when, in the opinion of the Executive Director, delay occurs and such delay is not the fault of the Contractor; or, when work is of such an important nature that delay in carrying such work to completion would result in serious disadvantage to the public.
- (b) When overtime work is ordered by the Board of Education, such "Order" will be issued on a special form letter over the signature of the Executive Director, Division of School Buildings.
- (c) When the Contractor receives such order, he shall make immediate application to the Industrial Commissioner of the N.Y. State Department of Labor for dispensation in accordance with subdivision 2 of Section 220 of the Labor Law. Upon receipt of such dispensation, Contractor shall proceed expeditiously with ordered overtime work.

15B-1.40. Tests

- (a) General  
The Contractor shall apply tests as specified below. No work shall be covered or concealed before it is tested. Piping may be concealed after the hydrostatic test and an inspection of the position, pitch and allowance for expansion has been made.
- (b) Hydrostatic Tests  
Piping of steam, condensate return, fuel oil, and hot and/or chilled water systems shall be tested at not less than 80-pounds per square inch hydrostatic pressure, maintained for at least 4-hours during the progress of installation, and all leaks shall be properly eliminated. Caulking of leaky joints is not

15B-1.40. Tests-(Cont.)

permitted. For testing purposes, end of piping to be tested shall be plugged or capped. Convectors, thermostatic vacuum traps, float-thermostatic traps, pneumatic valves and any other equipment or apparatus which may be damaged by this hydrostatic test shall be excluded from the test. See paragraph 15B-18.06 for testing of sprinkler system. High pressure steam piping (a system operating at a steam pressure of more than 15 psi) shall be hydrostatically tested at 150 percent of the design pressure, in accordance with the Building Code. Water piping shall be tested at 150 percent of design pressure, but never at less than 80 psi.

(c) Steam Test

After the entire steam heating plant has been installed, and all convectors, etc. throughout have been connected, the entire plant, including risers, radiation, mains, indirect heaters, etc., shall be subjected to a steam test of eight (8) pounds per square inch for a period of not less than 3-hours, which test shall be made in the presence of the Executive Director or his representative. Temporary steam gauges shall be installed at the boilers and at other designated points to provide for this test. After the test has been completed and found satisfactory, the temporary fixtures shall be removed.

(d) Adjusting Test

After the cleaning-out operation specified in Paragraphs 15B-1.41 and 15B-1.42 has been completed and approved by the Executive Director, the Contractor shall test and operate the entire plant for not less than five (5) working days, and the Contractor shall assume all responsibility for the safety of the entire plant during such operation. Motors, pumps, fans, compressors, and other appliances shall be tested and adjusted during this period. This five-day test may be included in the instructional period specified in Paragraph 15B-1.45.

(e) Should the work be in such state that the above five-day run is not sufficient to test and make adjustments to all parts of plant, including duct dampers, then the Contractor shall continue to run the plant continuously for such a period as, in the opinion of the Executive Director, may be necessary to complete the adjustment of all parts of plant, and until all parts of plant are so adjusted.

15B-1.40 Tests-(Cont.)

(f) Pump Tests

During the five-day test the vacuum pumps shall be tested as follows:

1. With all valves open and with no steam on the system, the vacuum pump shall raise a vacuum of at least 20-inches of mercury measured at the gauge at the pump. With the pump not operating for one hour, the loss of vacuum shall not exceed 3-inches of mercury.
2. With the pumps operating alternately, and with steam on the entire system, the pumps shall each maintain a vacuum of 5½-inches of mercury, as indicated by gauge on receiving tank at pumps. Steam pressure at boiler shall not exceed two pounds gauge pressure.
3. The above tests shall take place in the presence of the representative of the Executive Director. The Contractor shall give the Executive Director 48-hours notice in advance of this test.

(g) Damper Tests

The dampers, deflectors, etc., shall be tested and adjusted during the above five-day test run, but this work must be carried out by parties other than the man delegated to supervise the operation of plant and instruct the Custodian. For details of damper adjustments, see Par. 15B-17.24.

(h) Defective Material

Any defective material or workmanship disclosed by the above-mentioned tests shall be removed and replaced with new, and the test repeated. The final certificate will not be signed until all tests have been made and the work proved to be satisfactory to the Executive Director.

(i) Labor, Etc., for Tests

Contractor shall furnish all labor, apparatus, etc., required for testing and operating as outlined in Paragraphs 15B-1.40 and 15B-1.45. Fuel for tests will be furnished by the Board of Education.

(j) Time for Making Tests

All tests shall be made at times when the boilers are not being operated for temporary heat. The five-day test and the damper tests and adjustments shall be made starting when the period of "Instruction of Custodian," specified in Paragraph 15B-1.45, begins.

15B-1.41. Cleaning of Heating Plant

- (a) After the entire heating plant has been erected and vacuum traps have been installed, the plant shall be cleaned by operating it for a period of three (3) consecutive 8-hour working days with the boilers on low fire. During this period, the vacuum pumps shall not be operated, the return condensate being wasted to the sewer. At the end of this period all float and thermostatic traps throughout the building shall be thoroughly cleaned and left in perfect working order. At this time, the mud leg drains of each boiler shall be opened and the mud legs shall be flushed out by means of a water hose.
- (b) If temporary heat is required before the entire plant is erected, such radiation and piping as is then installed shall be cleaned out as specified in Par. (a), and this cleaning out operation shall be repeated after the entire plant has been completed.
- (c) After the boilers are cleaned as hereinbefore specified, the fire chambers, tubes and breechings of boilers shall be completely wire brushed and all soot shall be removed with a vacuum cleaning machine suitable for this purpose. In the event that the outside of boilers, piping, breeching, etc., have an accumulation of dirt, the dirt shall be removed with the vacuum cleaner.

15B-1.42. Cleaning of Hot and/or Chilled Water Systems

- (a) After the hot and/or chilled water systems installation has been completed and tested, they shall be chemically cleaned. Notify the Executive Director 48-hours in advance of starting the cleaning operation. In the presence of a representative of the Executive Director, one of the following solutions shall be placed in the system and circulated: (1) Tri-Sodium Phosphate - one pound for each fifty gallons of water in the system; (2) Sodium Carbonate - one pound for each thirty gallons of water in the system; or (3) Sodium Hydroxide (Lye) - one pound for each fifty gallons in the system. Their preference is in the order named, and a solution of only one type shall be used.
- (b) Fill, vent, and circulate this solution through the system, allowing it to reach design or operating temperature. After circulating for not less than 8-hours, the solution shall be drained completely from the system, strainers shall be cleaned, and the system shall be refilled with fresh water. The water shall be circulated for one hour, and, at that time, a sample of the water shall be tested for alkalinity in the presence of a representative of the Executive Director. A pH reading between 7 and 8 shall be obtained in order to receive approval.

15B-1.43. Treatment of Boiler Water

The Contractor shall employ the services of a qualified water treatment specialist, acceptable to the Executive Director, who shall maintain the boiler water at optimum condition so as to minimize boiler corrosion. Contractor shall submit, for approval by the Executive Director, an outline of the water treatment the specialist proposes to use. The services of the water treatment specialist shall begin at the conclusion of the cleaning period or at the beginning of the temporary heat period, whichever first occurs, and shall continue until the end of the warranty period. During this time, a certified laboratory report of the water condition of each boiler shall be forwarded to the Executive Director each month.

15B-1.44. Treatment of Hot and/or Chilled Water Systems

The Contractor shall employ the services of a qualified water treatment specialist, acceptable to the Executive Director, who shall maintain the water in each hot and/or chilled water system at optimum condition to inhibit corrosion, pitting, rust and scale formation. Contractor shall submit for approval by the Executive Director, an outline of the water treatment the specialist proposes to use. The services of the water treatment specialist shall begin when the testing and cleaning of the water systems have been satisfactorily completed, and shall continue until the end of the warranty period. During this time, a certified laboratory report of the water condition of each chilled water system shall be forwarded to the Executive Director each month.

15B-1.45. Instruction of Custodian

- (a) The Contractor shall furnish the services of competent personnel, whose duty shall be to instruct the Custodian in the operation of the heating, ventilating and air conditioning equipment. The instruction period shall total ten (10) days, which shall be apportioned as follows:
1. The Custodian shall be instructed in the operation of the heating and ventilating systems on five (5) consecutive school days from 8 A.M. to 3 P.M. during the heating season of October 1st to April 1st.
  2. The Custodian shall be instructed in the operation of the refrigeration equipment during the two (2) consecutive days period specified in Par. 15B-23.00(c).

15B-1.45. Instruction of Custodian-(Cont.)

3. The Custodian shall be instructed in the operation of the temperature control system and any other equipment installed under this contract during a three (3) day (not necessarily consecutive) period from 8 A.M. to 3 P.M., as selected by the Custodian.

(b) Manual of Operating Instructions

Contractor shall furnish the Custodian with three (3) copies of a Manual of Operating Instructions, which shall be type written (double spaced) on heavy bond paper and bound into a loose-leaf type book. The Manual shall contain complete starting and stopping instructions for each item of machinery and each heating, ventilating and air conditioning system installed as part of this contract. Actual location of starter or contactors of each item of machinery shall be indicated. A copy of the valve chart specified in Par. 15B-9.08 shall also be included in this Manual. Contractor shall deliver the copies of the Manual to the Custodian prior to the 3-day instructional period specified in (a)3, and shall obtain a signed receipt for same.

15B-1.46. Field Office, Storage, Sheds, Etc.

The Contractor shall furnish, erect and maintain a field office, if required, of suitable size for his own use, and shall also provide and maintain material sheds, protections, or other structures as may be required for any of the work or for the storage of his materials. The locations of such structures shall be such as will not interfere with the progress of any of the work. The Contractor will not be permitted to use any room or space in the building for a field office or for the storage of materials, except upon written consent of the Executive Director, and then for an agreed stated period only. No restaurants, lunchrooms, or other concessions of any kind whatsoever shall be operated on the site of this project except with the written permission of the Executive Director.

15B-1.47. Posters and Signs on Sheds or Buildings

No posters, advertising billboards or signs of any nature shall be placed on any part of any post, fence, bridge, railing, shed, building or structure of any kind erected in or about the premises, except such as may be necessary in connection with the work under this contract to identify the Contractor and his work.

15B-1.48. Water

(a) New Buildings

1. As part of the work of his contract, the Contractor for Plumbing and Drainage Work will provide labor required for maintaining all water services for temporary toilets and for maintaining water services for work on the premises from 7:45 a.m. to 4:15 p.m. on all regular working days, not including Saturdays, Sundays and holidays. Contractor for Plumbing and Drainage will be responsible for temporary water service on holidays as defined in the Plumbers' Union Contract and not as defined in contracts of other trades.
2. Whether OR NOT the use of water is required for the work on the premises (except for temporary heat) before 7:45 a.m. and after 4:15 p.m. on any regular working day or at any time on Saturdays, Sundays or Holidays, the HVAC Contractor hereby agrees to pay the Contractor for Plumbing and Drainage work the entire cost of maintaining such services during these overtime periods and shall further be required to verify by signing daily work tickets for such contractor, indicating the number of such overtime hours worked to provide temporary water services.
3. If more than one Contractor is involved, the cost shall be prorated among the Contractors involved. The Contractor and/or Contractors involved shall pay the cost incurred by the Plumbing and Drainage Contractor monthly upon submission of bills, indicating the respective costs. The Board of Education will not be a party to any agreement between Contractors and will not pay any of such costs.

(b) Existing Buildings - Modernization and Alteration Work

1. Water required for construction may be taken only from existing hose bibbs or Janitor's Sink Closets.
2. This Contractor shall allow an amount in his bid equal to \$12.08 for the first \$1000 or fraction thereof and \$4.03 for each additional \$1000 or fraction thereof of his bid price. This amount is to appear as a separate item on his submitted "Schedule of Items and Costs", entitled "Water usage charge". Within thirty (30) days of his receipt of Notice to Begin Work, the Contractor shall pay the Bureau of Water Register the required fee as calculated above. The receipt for this fee shall be presented with the payment requisition voucher requesting payment for this item.



15B-1.49. Temporary Light and Power

- (a) Suitable outlets for temporary lighting throughout the building, together with outlets for portable extensions and for pipe threading machines will be provided by the Contractor for Electric Work as indicated in the Specifications for Electric Work.
- (b) The Contractor for Electrical Work will also provide such temporary or permanent wiring connections as conditions require or permit for such apparatus as may be needed for temporary heating of the building. For oil burning installations, the Contractor for Electric Work will provide permanent or temporary service to the main switch on the control panel. All other wiring necessary for operation of the oil burners and accessories shall be installed, complete, by the HVAC Contractor.
- (c) Should this Contractor desire or require any wiring, fittings, outlets, etc., for lighting or portables in addition to that specified to be installed by the Contractor for Electric Work, he shall provide same, at his own expense. Wiring, trailers, attachments, etc., shall be approved by the Executive Director before they are attached to the temporary light and power system.
- (d) Current for all apparatus necessary for temporary heat and for all lighting required will be paid for by the Contractor for General Construction but the HVAC Contractor shall pay the Contractor for General Construction for all other current he may use for power purposes, except when the Board of Education pays the Utility Company directly for any such current.

15B-1.50. Overtime Use of the Temporary Light and Power System

The term "overtime use of the Temporary Light and Power System" shall mean use of the system before 7:45 A.M. and after 4:15 P.M. on any regular working day, or use of the system at any time on a Saturday, Sunday or a Holiday (holidays shall be as defined in the Electricians Union Agreement). Any Contractor requiring Overtime Use of the Temporary Light and Power System shall pay the entire cost of keeping the system energized and maintained during the overtime period. If more than one Contractor is involved, the charge shall be pro-rated among Contractors. The Contractor for Electric Work and the Contractor or Contractors requiring such overtime use of the Temporary Light and Power System shall agree on cost and manner of payment prior to commencing work. The Board of Education will not be a party to any agreement between Contractors,

15B-1.50. Overtime Use of the Temporary Light and Power System

and shall not pay any part of the cost of energizing or repairing the system during the overtime period; nor settle any disputes arising from such agreements. This paragraph shall not apply to the maintenance of temporary heat.

15B-1.51. Temporary On-Site Exterior Security Lighting System

A temporary on-site exterior security lighting system will be furnished and installed by others. Should any part of this lighting system interfere with the work of the HVAC contract, that part of the lighting system will be removed and replaced or relocated by others to permit the work of this contract to be performed. The cost involved in such removal and replacement or relocation shall be borne by this Contractor, as part of his contract.

15B-1.52. Temporary Heat

- (a) HVAC Contractor shall have the boiler plant fully prepared for complete operation to maintain temporary starting October 15th, provided that major portions of the building are enclosed by wall, floor and roof slabs, and provided that exterior openings are closed. The boiler plant and sufficient radiation shall be installed, as well as control panels, pumps, oil heaters, safety devices, etc. as specified in Section 15B-7, so that the plant will be operated safely and economically. The burning of wood, paper or other similar materials will not be considered as supplying temporary heat and will not be paid for as such.
- (b) The Contractor shall begin to supply temporary heat only when so directed in writing by the Executive Director and shall continue to supply temporary heat until directed in writing by the Executive Director to discontinue. In no case, however shall temporary heat be supplied after April 30th, except upon written instructions from the Executive Director. The following minimum temperatures shall be maintained:
1. Throughout the building, 60<sup>0</sup>F.
  2. In locations where painting and/or varnishing is being done, or where wood or resilient flooring or vinyl base is being installed, 70<sup>0</sup>f.
- (c) Temporary heat shall be supplied by convectors (with or without enclosures) permanently connected. Sections of the building which are not designed to be heated by means of convectors, or where the permanent installation of convectors has not been completed, shall have temporary convectors installed with temporary piping connections. Indirect heaters (including unit ventilators, etc.) shall not be used for temporary heat.

15B-1.52. Temporary Heat-(Cont.)

- (d) The total amount of radiation provided for temporary heat shall be not less than is required to maintain the specified temperature. Convectors shall be connected temporarily with steam and return piping and with a thermostatic trap at each convector return. Temporary convectors and temporary piping connections for them shall be removed at the end of the temporary heating period. In the event that the temporary convectors interfere with the laying of finished floors by the Contractor for General Construction, the convectors and piping shall be disconnected and re-connected after the floors are laid. Care shall be taken to prevent damage to the finished floors.
- (e) The temporary convectors shall be connected to the nearest steam and return risers or mains, or temporary mains shall be installed for this purpose, as directed. Temporary mains, etc. shall be disconnected and removed at the end of the temporary heating period. Piping materials used for temporary mains may be those furnished as part of the Contract.
- (f) Before making fires in any boiler, the HVAC Contractor shall thoroughly inspect the smoke breechings and chimneys to see that they are clean, clear and free of obstruction. If not so found, the Contractor shall notify the Executive Director and await his instructions.
- (g) Vacuum pumps shall be placed in operation beginning 24-hours operating time after starting the plant for temporary heat.
- (h) Contractor shall clean boiler tubes every two (2) weeks during temporary heat period. After termination of temporary heat, Contractor shall thoroughly clean the boilers and burners and leave them ready for future operation.
- (i) The Contractor shall employ competent personnel who have Operating Engineer's License or Certificate of Fitness to operate the boiler plant for the purpose of supplying temporary heat. The Contractor shall furnish all material required for the operation of the plant, exclusive of fuel. He shall maintain the plant in working order, shall be solely responsible for the plant and shall make good any damage to it from any cause when supplying temporary heat. When operating a boiler plant in an existing building for temporary heat purposes, the Contractor shall also be responsible for the present equipment while operated by him and shall make good any damage, breakage, etc., due to improper operation or negligence on his part.

15B-1.52. Temporary Heat-(Cont.)

- (j) Contractor shall operate the heating plant with electric current furnished as specified in Par. 15B-1.43. Gas will be furnished by others. The Contractor for Plumbing and Drainage will install a gas line near each boiler, to which the HVAC Contractor shall make connection.
- (k) Fuel for temporary heat will be furnished by the Board of Education. The Contractor shall notify the Executive Director of the quantity of fuel needed at least 3 days in advance of the date when delivery is required. Contractor shall pump the oil tanks dry and shall thoroughly clean the interiors with wire brush before they are placed in use.
- (l) During the temporary heating period, the General Construction Contractor will exercise supervisory control over the condition of the building, opening and closing windows as weather conditions require. It will be his responsibility to try to maintain uniform temperature within the building so as to prevent shrinkage, cracking or swelling of floors, trim and other work in the building due to varying temperature conditions.
- (m) In rooms where plastering is being done, the General Construction Contractor will provide suitable protection for the purpose of keeping the convectors free of plaster.
- (n) In the event that the Plumbing and Drainage Contractor has not installed a permanent water main to supply water to the boilers in time for the temporary heating period, he will install a temporary water line for this purpose, terminating in the boiler room. HVAC Contractor shall temporarily connect to this outlet to supply water to the boilers for temporary heat and shall remove these temporary connections when conditions are such that permanent water connections can be made without interrupting the water supply to the boilers.
- (o) The Board of Education will pay the HVAC Contractor in the manner indicated in the amendment to the Instructions to Bidders for each 8-hour shift that temporary heat is furnished. The Contractor shall accept such payment as full compensation for supplying temporary heat in accordance with these specifications. There will be no extra compensation for insurance or cost of management or maintenance, in connection with the services, labor or materials furnished.

15B-1.52. Temporary Heat--(Cont.)

- (p) Applications for payments for temporary heat shall be made monthly on separate application blanks, without regard for other work performed. Each application shall include a certificate of the Contractor stating the hourly periods of each day during which temporary heat was furnished, that boiler tubes were cleaned as specified, and that the labor assigned to temporary heat duty was not utilized for work other than that attributable to temporary heat.
- (q) Contractor shall include in his bid, the cost for temporarily furnishing, connecting and disconnecting mains, piping and radiation for temporary heat. He shall indicate this cost as a separate item on the "Schedule of Items and Costs".

15B-1.53. Removal of Rubbish

- (a) The Contractor for General Construction will be responsible for removal of all rubbish until the completion of the work of the General Construction contract. From then on, HVAC Contractor shall keep the building, premises and surrounding sidewalks and streets clean and free from his rubbish and discarded or surplus material. He shall provide suitable receptacles of adequate size and number, in handy locations about the premises to receive his own rubbish and discarded or surplus material, and also that of his subcontractors and shall require his subcontractors to deposit their rubbish and surplus material in the receptacles provided for this purpose, or in orderly piles in locations as he may designate. He also shall provide the labor required to remove said rubbish and discarded or surplus materials from the various floors and yards, and shall cart it from the premises, leaving the building "broom-clean", so far as his rubbish and that of his subcontractors is concerned. See also Par. 15B-2.04(c).
- (b) Should the HVAC Contractor fail to keep the building, premises and surrounding streets clean and free from rubbish, as specified in paragraph (a), then the Executive Director will employ such parties as he pleases, in the open market to remove the rubbish and will withhold from any payments due the Contractor such sum as may be required to pay for the removal of the rubbish or material, and such sum shall be deducted from the amount of the contract.

15B-1.54. Protection

- (a) Care shall be taken by mechanics and other workmen doing any work in or around locations where the finished coat of plaster has been applied so that they will not mark, soil or deface plastered surfaces in any way. In the event that any finished plastered surfaces become marked, soiled or defaced by mechanics or workmen in the employ of the HVAC Contractor or any of his subcontractors, then this Contractor shall clean and restore such plastered surfaces to their original, clean condition.
- (b) Care shall be taken to protect equipment such as air compressors, boilers, fans, motors, pumps, convectors, etc., after delivery into the building. In addition, air compressors, refrigeration equipment, pumps and motors shall be protected by tarpaulins and shall be kept clean and dry until completion of the work.

15B-1.55. Cleaning

At the completion of the work and before the final inspection is made, the HVAC Contractor shall thoroughly clean all fixtures, apparatus, appurtenances, piping, brass and chrome plated work furnished by him, and leave same free of marks, scratches, stains, etc. Pumps, heaters, etc., shall be cleaned and left in condition to operate, and the work, as a whole, left in perfect working order. Tools, debris, etc., of whatever nature shall be removed from the premises.

15B-1.56. Torch Burning Operation

- (a) Torch burning operations utilizing oxygen and/or other combustible gases shall be performed in strict accordance with F.P. Directive 3-60, dated June 29, 1960, specifying Fire Department rules and regulations for issuance of permits for storage and use of oxygen and combustible gases during temporary and emergency torch burning operations together with the following additional precautionary measures:
  - 1. No oxygen or combustible gas cylinders shall be stored on premises.
  - 2. Each oxygen or combustible gas work area shall be separated from other areas of premises, and a qualified fire guard shall be maintained on duty to insure aforementioned separation. Separated, as used herein, shall mean a temporary barricade to prohibit entrance by unauthorized persons.
  - 3. After oxygen and combustible gas operations have been completed a qualified fire guard shall be continued on duty for a total of 1½ hours during which time he shall make three (3) complete inspections, at half hour intervals, of entire work area for purpose of detecting fire.

15B-1.56. Torch Burning Operation

4. The use of liquefied petroleum gases in occupied places of assembly is strictly prohibited.
- (b) Each contractor performing torch burning operations shall apply for and obtain a Fire Department permit before commencing such work. Also, each torch burning operator shall carry on his person, at all times, a current certificate of fitness issued by Fire Department to perform this type of work.
- (c) Fire guard shall be stationed in work area at all times during torch burning operations and thereafter as indicated above.
- (d) Cost of permits, certificates, fire guards, barricades, etc. required in connection with torch burning operations shall be borne by this Contractor at no additional cost to the Board of Education.

SECTION 15B-2  
WORK IN PRESENT BUILDING

NOTE: This Section applies only to work in Present Buildings which are being enlarged and/or altered.

15B-2.00. Examination of Present Building, Etc.

This Contractor shall visit the premises, including the present building, and compare same with the drawings and specifications and satisfy himself of the conditions existing at the premises including the present building before delivery of his proposal. No additional allowances will be made to the Contractor due to his neglect or failure to comply with the specified requirements.

15B-2.01. Removals, Replacement, Adjustments, Etc.

- (a)
1. This Contractor shall remove, relocate, replace, adjust or adapt existing piping, ducts, smoke breechings, conveyors, radiators, coils, thermostats and other heating and ventilating equipment or apparatus as required by the drawings and specifications, and also as may be required when such heating and ventilating work is uncovered or when found to interfere with the carrying out and completion of the work of this Contractor for General Construction, Plumbing and Drainage and Electric Work.
  2. The work shall include the furnishing of all materials, cutting, extensions, connections, removing, repairing, adapting, and other work incidental thereto, together with such temporary connections as may be required to maintain service pending completion of the permanent work.
  3. The work shall also include the removal of furniture, fixtures, coal, and other materials as directed which may interfere with the installations. All such disturbed materials, fixtures, etc., shall be replaced and rearranged to suit the new conditions.
  4. In locations where new flooring is to be installed, or where plastering is required behind existing radiators, the HVAC Contractor, when directed, shall disconnect and reconnect the radiators as indicated on the drawings. In such cases, care shall be taken in handling the radiators to eliminate the possibility of leaks resulting from damage to them.
  5. All work shall be left in good working order and in a condition equal to the adjacent new or existing work. Any work not shown on the drawings



15B-2.01. Removals, Replacement, Adjustments, Etc.--(Cont.)

or specifically mentioned in the specification but considered necessary for the proper completion of the work shall be provided by this Contractor without additional charge.

(b) Opening for New Boilers

When new steel boilers are to be provided, Contractor for General Construction will provide a boiler intake opening in the building wall for admission of the new boilers through the wall as shown on the General Construction drawings, which this Contractor shall examine. HVAC Contractor shall remove any obstructions that may interfere with the moving into position and the installation of the new boilers, and shall restore the removed equipment to its original location.

(c) Thermostatic Control Changes

Thermostatic air piping shall be relocated when it is found to interfere with the building alterations, or removed when it is not needed. Unused outlets shall be plugged. This shall be done at the time the building alterations are being done by the Contractor for General Construction. Thermostats to be relocated shall be disconnected, overhauled and reinstalled at the locations shown on the drawings. All exposed air piping in finished rooms installed as part of this contract shall be enclosed in "Wiremold" conduit, or other approved equal.

(d) Existing riser and runout casings shall be adjusted where necessary to suit the new conditions.

(e) Where new outlets are to be provided in present mains, approved welding fittings may be welded into the mains or the mains may be cut and threaded, and threaded fittings inserted.

(f) Where present system is changed from gravity return to vacuum return, all existing radiators, heaters, etc., that are to remain in service shall be equipped with vacuum specialties, etc., and all air valves shall be removed. Openings for removed air valves shall be plugged.

(g) Unless otherwise specified, the new or altered piping or ductwork shall be supported on hangers from beam clamps secured to the overhead beams. Remove concrete fireproofing in way of clamps and replace after hangers are installed. If Contractor proposes an alternate method of supporting piping or ductwork, he shall obtain permission in writing from the Executive Director before starting this phase of the work.

15B-2.01. Removals, Replacement, Adjustments, Etc.-(Cont.)

- (h) Portions of ductwork, breechings, piping, control wiring, and conduit, boxes, supports, hangers and similar items which are no longer required because of the removals specified or indicated on the drawings shall be removed back to point(s) of connection to the systems which will remain. Connections which will no longer be required in existing systems which will remain shall be sealed and/or plugged as close to the active portion of each system as possible.

15B-2.02. Matching Apparatus and Materials

Where the present facilities are to be extended, new apparatus or materials furnished shall match existing work in quality, finish, appearance, design, and operation.

15B-2.03. Cutting and Repairing

- (a) HVAC Contractor shall do his own cutting and removal of his related work in all locations where required, excepting where otherwise shown on the drawings and/or specified.
- (b) The patching and repairing shall be done as part of the work of the HVAC Contractor.
- (c) The above work shall include but not be limited to cinder block, hollow tile block, lightweight concrete block, gypsum block, concrete work, tile work, etc.
- (d) Damaged Work, Etc.

Where present work is damaged in the execution of this contract, or where openings are left due to the removal of fixtures, pipes, equipment or apparatus, the work shall be repaired or closed up to correspond in material, quality, shape and finish with that of similar and adjoining work, unless otherwise indicated in the drawings or specifications.

- (e) Damaged Apparatus

Should any damage, due to the execution of this contract, occur to the furniture, fixtures, or any other equipment or apparatus, such damage shall be repaired and made good without extra charge, with the supply of new articles, or otherwise, as may be required to leave the building and plant in perfect order at completion.

15B-2.03. Cutting and Repairing-(Cont.)

(f) Painting

The surfaces of all wood, brickwork, metal, plastering and other work that are to be painted or varnished in present building, shall be prepared by nailing, piecing, puttying, scraping, pointing, cleaning, sandpapering, etc., either in part or all over, as the case may require. Surfaces of walls, etc., that may become exposed due to removal of equipment, etc., by this Contractor, shall also be repaired, painted, etc., to match the surroundings. This painting shall apply only to rooms not to be painted by the Contractor for General Construction.

- (g) Openings through floor slabs for the installation of new piping shall be drilled from below upward, using an electric drill. These holes in no case shall be more than 2-inches larger in diameter than the finished openings are required to be.

15B-2.04. Use and Ownership of Removed Material

(a) Reused Material

Present material or equipment may be re-used only when same is specified or shown on the drawings to be re-used or relocated. All other materials and equipment shall be new and as specified. Where present radiation is re-located, new branch piping, valves, traps, etc., shall be provided for same, unless otherwise called for.

(b) Items of Equipment to be Removed to Bureau of Maintenance Shops.

1. The items of equipment as indicated on the drawings and as listed in the amendments shall be carefully disconnected, removed from their places of installation, properly packaged, and delivered to the Board of Education, Bureau of Maintenance Central Repair Shops.
2. Four (4) copies of a receipt indicating Contractor's name, trade, specification number, and equipment items must accompany the delivery of the items to the receiving office, and the four copies are to be signed by the Manager or his representative.
3. One (1) copy of the receipt is to remain with the Manager or his representative at the receiving office.
4. Three (3) copies of the receipt must be attached to bills submitted to the Board of Education for payment.
5. All items shall be delivered to the location designated within the receiving office.
6. A copy of that portion of the specification listing the items designated for salvage must be presented to the Manager or his representative at the time of delivery.

15B-2.04. Use and Ownership of Removed Material-(Cont.)

- (c) Material or apparatus specified or shown on the drawings to be removed and not to be re-used or stored shall become the property of the Contractor, who shall promptly remove same from the premises. The expense of removing it or the value thereof shall be taken into consideration at the time of making the bid. Removed material and equipment such as ducts, piping, machinery, boilers, etc., which are not to be re-used shall be promptly carted away from the premises. Removed (non-asbestos) insulating material and masonry will be carted away by the Contractor for General Construction.

15B-2.05. Time of Installation

- (a) The work shall be installed and the various changes in present work shall be made at such time and in such manner that the heating and ventilating systems of the present building are not interfered with, when heating and/or ventilating is required during school sessions. The work of taking down and removing any part of present equipment, of making alterations or of preparing for and placing new work therein, shall be done only after permission has been obtained from the Executive Director.

- (b) Obstructions

The Contractor shall take into careful consideration the fact that the sessions of the school will be continued as usual in the present building (except where specifically called for the building to be vacated by the Board of Education) until the new building is completed and ready for occupancy. The safety of the pupils and teachers renders it essential that nothing shall be done to block the streets in or about the exits, or the exits themselves, nor shall there be any interference with the free and unobstructed use of the hallways and other parts of the building.

15B-2.06. Protection

The premises shall not be used as a workshop to the detriment of any portion thereof. Neither the teachers' nor pupils' desks, tables or equipment shall be used as work benches, nor shall materials or other furniture be piled thereon without protection.

15B-2.07. Workmen's Identification

This Contractor and each of his employees, including subcontractors and their employees, shall wear an identification badge while on school premises. Badge shall include the name of the Contractor and the name and photograph of the employee. Badges shall be worn on outer clothing and shall be conspicuous at all times.

SECTION 15B-3  
EXCAVATIONS, FILLING AND GRADING

15B-3.00. Excavations

- (a) The HVAC Contractor shall, unless otherwise specified or indicated on drawings, do all excavating of earth, rock or other materials to the depth required to install the work of oil fill, oil vent and sprinkler system piping.

NOTE:

1. Excavation required under the terms of this contract shall be considered, for the purpose of bidding, as "earth excavation". Should rock, as defined in Section 2D, Par. 1.04 of the Standard Specification for General Construction Latest Edition (a copy of which may be seen at the Estimating Room), be encountered, same will be considered as an extra.
  2. Additional payment for each rock excavation will be made at a unit price per cubic yard stated in the Amendments, upon presentation of an affidavit, certified by the Contractor and approved by the inspector, stating the actual amount of rock excavated.
  3. The Contractor will not be paid for rock excavation exceeding in width or depth the actual amount of excavation necessary for the proper installation of his work. In case of dispute, the Executive Director shall be the sole judge and his decision shall be accepted by the Contractor.
- (b) In rock trenches, provide a bed of earth not less than 6-inches deep under all pipes.
- (c) Excavations shall not be made around city monuments and bench marks until said monuments or marks have been referenced and reset or otherwise disposed of by the Chief Engineer of the Department of Highways. The necessary labor and materials required to remove, care for, and reset such monuments and bench marks shall be furnished by the Contractor.
- (d) When the excavations are made by the General Construction Contractor, the excavated material will be left on the premises for the use of the HVAC Contractor. Additional material required to fill fully and grade trenches, etc., shall be furnished by the HVAC Contractor. He shall also remove surplus material from the premises.

15B-3.01. Backfilling and Grading

- (a) Trench shall be sufficiently filled with a layer of earth, soaked with water and thoroughly rammed, to provide a solid foundation under the piping. After installation of the piping, the trench shall be back-filled for at least half its depth with earth, free of large stones, placed in layers of not over 12-inches and thoroughly rammed in such a manner as not to disturb the piping, then flooded with water and left solid. Next, the trench shall be filled to the level of the earth filling for seeded, sodded or planted areas or cinder filling for concrete pavement with the materials removed in excavating, including that material left by the General Contractor for trench fillings.
- (b) All surplus excavated materials, including that left by the General Construction Contractor at locations where he has excavated for the HVAC Contractor, which are not suitable for grading or required for back-filling shall be removed from the premises by the HVAC Contractor.

SECTION 15B-4  
MASONRY WORK

15B-4.00. Scope

(a) Work Included

This Contractor shall completely construct the foundations for pumps, air compressors, refrigeration equipment, etc.; together with all other masonry and related work that may be shown on the drawings and/or specified.

NOTE: Proportions indicated in concrete and mortar mixes shall be measured by volume.

(b) Work by Others

1. Contractor for General Construction will provide the reinforced concrete slab in the boiler room designed to support the boilers, pipe trenches in the floor of basement or cellar, masonry fresh air intakes and the concrete curbs on roofs and in fan room slabs, unless otherwise shown on the drawings or specified.
2. Contractor for General Construction will also build an oil tank chamber and reinforced concrete slab in the chamber for the fuel oil storage tanks, unless otherwise shown on the drawings or specified.

15B-4.01. Sand

All sand used for making mortar or concrete shall be clean, sharp, coarse and silicious.

15B-4.02. Broken Stone

All broken stone used for making concrete shall be of trap rock, granite or other hard durable stone. It shall be free from dust, dirt or other foreign matter of any kind. 1½-inch broken stone shall pass through a 2-inch screen and be retained on a 1-1/8 inch screen.

15B-4.03. Cement

- (a) All cement used shall be true Portland cement of standard brand and manufacture and shall meet with all requirements of the Standard Specifications for Portland Cement of the American Society for Testing Materials, Designation No. C-150 Type I.
- (b) Cement shall be delivered at the site in original packages and in sufficient time to permit inspection of same. Packages shall bear the name of the manufacturer and the brand. All packages shall be properly stacked, completely covered and protected from the weather, dampness and damage.

15B-4.03. Cement-(Cont.)

- (c) The Executive Director reserves the right to take samples for testing from any or every lot of cement delivered at the site. The tests shall be made as determined by the Executive Director and the expense incurred in making these tests will be borne by the Board of Education. Any rejected cement shall be removed from the site immediately.

15B-4.04. Concrete

Concrete shall be composed of one (1) part of Portland cement, two (2) parts of sand, and five (5) parts of 1½-inch stone, all as specified and dry mixed, properly wetted, and tamped in place until the water flushes the surface. Layers of concrete shall not exceed 8-inches in depth and each layer shall be rammed, but not set before the next layer is applied.

15B-4.05. Cement Mortar

Top dressing of cement mortar on concrete floors, etc., shall be one (1) part Portland cement and one and one half (1½) parts sand, well mixed with sufficient water to make a stiff paste, colored as directed and applied immediately after forming concrete body. Mortar shall be mixed in no greater quantity than is required for the work on hand. Any excess that may be left longer than one (1) hour shall not be retempered but shall be discarded.

15B-4.06. Lime

All lime used shall be mild hydrated and shall comply with requirements for Hydrate Lime of the American Society for Testing Materials, latest revision. It shall be delivered in its original packages, which shall bear the name of the manufacturer and the brand

15B-4.07. Lime Mortar

Lime mortar shall be made of one (1) part of lime, one (1) part Portland cement and four (4) parts of sand, properly tempered and mixed.

15B-4.08. Fire Brick (High Alumina)

- (a) The fire brick in the windbox extension front shall be high alumina, made of Missouri or Pennsylvania clay by the dry press method, true and regular in shape and size and shall have the maker's brand molded in each brick. See the drawings.
- (b) The brick shall have a pyrometric cone equivalent not below cone 35, shall have an alumina content to not less than 60% (±2.5%) and shall comply in every respect



15B-4.08. Fire Brick (High Alumina)-(Cont.)

with the latest revised specification of the American Society for Testing Materials.

(c) Approved Makes and Brands

The following makes and brands of fire brick, subject to the above specified requirements, are approved. No other make or brand shall be used unless specified by Amendment. Contractor shall furnish the Executive Director with two (2) samples of the brick he proposes to furnish for the particular job. Samples shall be accompanied by a certified laboratory report and by a letter signed by an officer of the firm manufacturing the brick, stating that all brick and bonding mortar furnished for the particular job are in complete compliance with the specification requirements.

A.P. Green Company.....MIZZOU  
General Refractories Company.....ARCO-60  
Harbison-Walker Company.....ANCHOR  
J.H. France.....FRANCO  
Kaiser Refractories.....ALUMEX-60  
North American Company.....NARCAL-60

15B-4.09. Bonding Mortar for Fire Brick

All fire brick shall be laid in just sufficient air-setting high temperature bonding mortar to give an even and solid bearing and a tight joint. Care shall be taken that the mortar spreads over the entire surface of the brick. Bonding mortar shall be of the same manufacture as the fire brick used and shall be one of the following:

A.P. Green Co. "Sairset"  
General Refractories Co. "Brikbond A"  
Harbison-Walker "Harwaco Bond"  
J.H. France "Franset"  
Kaiser Refractories "Trowleze"  
North American Refractories Co. "Narcoset"

15B-4.10. Plastic Refractory

All plastic refractory shall be air setting type, of super duty quality, and shall have a pyrometric cone equivalent not less than cone 32½ (3135<sup>0</sup>F.) Plastic refractory shall be installed by the pounding method and shall be securely anchored to the adjacent work by means of heat resisting alloy iron or refractory anchors or combination of both, and ample provision shall be made for expansion. Plastic

15B-4.10. Plastic Refractory

refractory shall be A.P. Green's "Super Hybond (air setting)", General Refractories' "Super Brick Ram Mix G (air setting)", Harbison Walker's "Super Plastic CS (air setting)", J.H. France's "Super Franco Plastic (air setting)", Kaiser's "Max Bond (air setting)", or North America's "Narco-Spar (air setting)".

15B-4.11. Castable Refractory

- (a) Castable refractory for boiler linings shall be made of insulating castable refractory having a maximum temperature rating of 2800<sup>0</sup>F. and shall be A.P. Green's "Super Kast-Set", General Refractories' "Super Ferro-Cast", Harbison Walker's "H-W Super Castable", J.H. France's "Hydrecon 5", or Kaiser Refractories' "Super Furnas-Crete".
- (b)
  1. Furnish and install a refractory floor of 4-inch minimum thickness in each return tubular firebox boiler during the two week period immediately prior to the installation of the oil burner. Do not install the refractory when the air temperature in the boiler room is at or below 32<sup>0</sup>F. Deliver refractory to boiler room in containers marked with manufacturer's name and brand. Mix and apply refractory in accordance with manufacturer's directions. Curing and firing of refractory shall also be in accordance with his directions.
  2. Castable refractory for boiler floors shall have a maximum temperature rating of 3000<sup>0</sup>F. and shall be A.P. Green's "Mizzou Castable", C-E Refractories' "Fractocrete 3000", General Refractories' "Brik-Cast 3000", Harbison Walker's "H-W High Alumina", J.H. France's "Hydrecon 3000", or Kaiser Refractories' "Purocast 3000". Submit manufacturer's technical data sheet for approval before installing refractory floor.

15B-4.12. Foundations for Machinery

- (a) Masonry foundations under pumps, compressors, and where else required shall be built of concrete, mixed as hereinbefore specified and poured into forms. Forms shall be built of plywood or masonite, reinforced to retain true and even shape, with the side next to the concrete coated so that a perfectly smooth surface will result. Where a sub-base does not cover the entire top of foundation, top horizontal edges shall be provided with an angle frame, anchored to the foundation.

15B-4.12. Foundations for Machinery-(Cont.)

- (b) The concrete foundations shall be set directly on the rough floor slab unless otherwise shown on the drawings or specified. If non-waterproof cement finish already occurs, it shall be removed down to the rough slab and the floor slab shall be well roughened and wetted before pouring the foundations so that a good bond is obtained. The cement finish on the floor surrounding these foundations, when laid or replaced by this Contractor, shall be finished off at the concrete foundation to form a cove. The height of foundations above the finished floor shall be 4-inches for pumps, tank mounted air compressor unit and fuel oil pump and heater set, unless otherwise specified or shown on the drawings.

NOTE: Where the floor is waterproofed or finished with waterproof cement, the foundations shall be so installed that the waterproofing is not damaged.

- (c) This Contractor shall furnish templates, anchor bolts, etc. Bolts shall be built into the foundations with ample size pipe sleeves.

15B-4.13. Supports for Fuel Oil Storage Tanks

Fuel oil storage tanks shall be installed within the building at the locations shown on the drawing. Contractor for General Construction will provide a reinforced concrete floor slab within the tank chamber, and access doors in the enclosing walls. HVAC Contractor shall provide approved cast iron or welded steel saddles under the tanks and level them by grouting to distribute the weight of the tanks evenly. Tanks shall be installed in place before the slab over the enclosure is poured (unless otherwise directed), so as not to delay the work of the General Construction Contractor.

SECTION 15B-5  
BOILERS

15B-5.00. General

- (a) Furnish and install oil fired low pressure heating boilers of the size, number and type indicated on the drawings. Boilers shall be as specified herein.
- (b) Boilers shall be set level on the concrete base provided by the General Construction Contractor in the Boiler Pit. The water line in all boilers shall be the same height above the finished floor. Install steel shims, if necessary, to accomplish this result.
- (c) Boilers shall not be installed until the Boiler Pit floor finish (whether waterproof type or not) has been completed. The grounding electrode specified in Par. 16-5.05 shall be installed prior to the pouring of the concrete base for the boilers.
- (d) Contractor shall comply with Department of Buildings regulations concerning the installation of the boilers, and shall file with that department all required information before starting the boiler installation.
- (e) Boilers shall have been approved by the N.Y.C. Department of Environmental Protection (Air Resources). They shall also have been approved by the Materials and Equipment Acceptance (M.E.A.) Division of the Department of Buildings. The M.E.A. approval number shall be indicated on the shop drawings.

15B-5.01. Design and Materials

- (a) Boilers shall be constructed in strict accordance with the ASME Boiler and Pressure Vessel Code and its Addenda in effect at the time of bid, and with the requirements of the City of New York, the State of New York, and any other public authorities having jurisdiction. Boilers shall be not less than the rating shown on the drawings, and the height shall fit the space available, leaving ample allowance for drawing tubes, smoke connections, piping, etc. No dampers shall be furnished for the boilers.
- (b) Furnace volume of each boiler (above the floor refractory) shall not be less than SBI minimum requirement for mechanical draft operation.
- (c) All materials used in the fabrication of the boilers shall be manufactured in the United States.

15B-5.01. Design and Materials-(Cont.)

- (d) Contractor shall submit with the shop drawings an affidavit from the boiler manufacturer stating that all materials used in the fabrication of the boiler have been manufactured in the United States. In addition, before delivering the boiler, he shall furnish a copy of the manufacturer's purchase orders for the tubes, sheets, etc. used in its manufacture.

15B-5.02. Tubes

- (a) Each boiler shall be provided with tubes of such number and length as to obtain the required heating surface indicated on the drawings. Tubes shall be not less than 3-inches in diameter, with a wall-thickness not less than 0.105 inches. Their positions shall be staggered, and they shall be spaced to permit free water circulation. Tubes shall be formed of hot finished seamless steel (A.S.T.M. A 83 or ASME SA-83), or of electric resistance-welded low carbon steel (A.S.T.M. A 178 or ASME SA-178).
- (b) Tubes shall be tightly expanded into openings in tube sheets by means of a roller type expander, with the ends of uniform length and not broken with chipping chisel. Ends of tubes shall not extend more than 3/8 inch or less than 1/4-inch beyond the face of the tube sheets and shall be flared, rolled over and beaded.
- (c) On demand in writing from the Executive Director, the Contractor shall remove one tube in each or any boiler, as directed, and shall replace such tube or tubes with new tubes to match, if the tubes are found to be acceptable. If tubes are found to be other than as specified above, all shall be removed and new tubes complying with this specification in all details shall be furnished.

15B-5.03. Outlets

- (a) Each boiler shall be provided with outlets welded to the shell, of the size, type, and location shown on the drawings, on the standard details, or as specified. All outlets shall be protected with iron screw plugs or metal caps, and flanged outlets with suitable blank flanges before the boilers are shipped from the factory. Method of protecting these outlets shall be indicated on the shop drawings. Unused outlets shall be plugged with iron screw plugs after installation of the boilers, and shall be proven tight under pressure.

15B-5.03. Outlets-(Cont.)

- (b) Provide a draft sampling tube in the rear wall (or in the side wall near the rear). Tube shall be 1¼-inch minimum size, Schedule 80 pipe, with male thread at outside end. Tube shall extend not more than ½-inch beyond the combustion chamber wall surface and shall extend at least 3-inches beyond the outer wall (to allow for boiler insulation) where it shall be capped.

15B-5.04. Manhole, Handholes, Etc.

A 15-inch x 11-inch (minimum size) manhole shall be provided in the top of the shell of each boiler, together with a steel manhole cover having bolt, yoke, and gasket. Each boiler shall be equipped with a suitable number of handholes or screwed washout openings. Screwed washouts shall be provided with brass plugs. Compact boilers shall have a minimum of four such openings, to give access to all mud rings. Wash-out openings on the front of Scotch marine boilers shall be located to clear oil burner windbox (specified in Par. 15B-7.01), and to be completely accessible without necessity of removing the burner windbox.

15B-5.05. Grounding Studs

Each boiler shall be provided with means of grounding it electrically. It shall consist of a ½-inch steel stud fitted with two nuts welded to the front and rear tube sheets, approximately 3-inches above the mud ring. After the boilers have been installed, the studs shall be connected by a No. 2 copper conductor to a grounding electrode located near the rear of the boiler. The connecting conductor shall be clamped to the boiler skid. Grounding electrode shall consist of one of the following:

- (a) Approved non-ferrous rod, not less than ½-inch diameter, driven to a depth of at least 8-feet.
- (b) Bare copper cable, 250 MCM minimum, at least 8-feet in length buried at least 18-inches below ground surface.
- (c) Non-ferrous plate, at least .060-inch thick, presenting not less than 2-square feet of surface to exterior soil, buried at least 18-inches below ground surface. The grounding conductor shall be bolted and brazed to the plate.

15B-5.06. Boiler Number Plate

Provide a number plate for each boiler, as required by New York City ordinances. Numbers shall be of solid brass, not less than 2-inches in height. Each number shall be mounted on a steel plate, which shall be secured to a front smoke box door.

15B-5.07. Painting

Boilers shall be primed painted at the shop with one coat of red oxide paint or zinc chromate paint. See Section 15B-21. The shop coat shall provide a complete protective covering. All damaged spots shall be touched up by this Contractor after installation, before insulation is applied.

15B-5.08. Inspection

- (a) The boilers shall be inspected during construction in the shop of the manufacturer by an inspector of an approved boiler insurance company, or of a State Labor Department. After completion of construction, each boiler shall be successfully tested at the shop at 60 psi hydrostatic pressure. The boiler shall be stamped legibly with all identifying marks and symbols, the manufacturer's name, the allowable working pressure in pounds per square inch, the year of manufacture, and all other markings required by the latest editions of the N.Y. State and the ASME Boiler Codes. Insulating covering shall be left off the above stampings.
- (b) Furnish and deliver in duplicate, one copy to the Executive Director and one copy to the Boiler and Licensing Division of the Department of Buildings of the City of New York, a certificate of test and inspection for each boiler issued by the boiler insurance company or State Labor Department which made the inspection. These certificates shall furnish all data required by the N.Y. State and ASME Codes.

15B-5.09. Hydrostatic Test

- (a) Contractor shall arrange for tests of the boilers at  $22\frac{1}{2}$  psi hydrostatic pressure by the Department of Buildings, and shall pay all fees involved. He shall notify the Executive Director by letter, at least 48-hours in advance of the time at which such tests are to be made. (The safety valves shall be gagged during the  $22\frac{1}{2}$  psi test, and then shall be hydrostatically tested at 15 psi.)
- (b) Each boiler shall be connected completely, including water feed, steam connections, trimming, surface and bottom blow-offs, etc., with valves inserted in connections to mains, and ends left open until after tests have been applied to prove that the valves are tight under the specified pressure.
- (c) A certificate of the Department of Buildings test shall be obtained by the Contractor, and shall be delivered to the Executive Director immediately after the boiler tests have been completed.

15B-5.10. Boiler Delivery

- (a) Boilers shall be delivered into the building through the boiler intake opening provided by the Contractor for General Construction, who will close up the intake opening after the boilers are in place.
- (b) Contractor shall place the purchase order for the boilers immediately after signing the Contract, and shall have the boilers delivered to the job as soon as possible, consistent with the job conditions, in order not to delay the furnishing of temporary heat.

15B-5.11. Shop Drawings

Contractor shall submit to the Executive Director for his approval complete shop drawings and specifications of the boilers, showing all dimensions, plate thickness, method of staying, staybolt layout, supports, outlets, manholes, refractory, and other essential details. The affidavit specified in Par. 15B-5.01(d) shall be included with the shop drawings.

15B-5.12. Approved Makes

Boilers manufactured by Burnham Corp., Federal Boiler Co., or Kewanee Boiler Corp., built in strict accordance with the specifications, drawings and job conditions, will be approved.

Three-Pass Firebox Type Boilers

15B-5.15. General

Units shall be welded steel, three-pass steam boilers of the compact design for use with forced draft burners. The boilers shall have not less than five (5) square feet of fireside heating surface per boiler horsepower gross rating. A circular opening, sized to receive the oil burner windbox being furnished, together with means for attaching same, shall be provided in the front water wall. Each boiler shall be equipped with a structural steel "skid" type base. A peep sight fitted with Pyrex glass, shall be provided in the rear of the boiler. Three-pass design boilers shall comply with the requirements of Paragraphs 15B-5.00 to 15B-5.15.

15B-5.16. Smoke Boxes

Front and rear smoke boxes shall be constructed of not less than 3/16-inch steel plates, and shall be welded to the boiler with a continuous seam. Rear smoke box shall have top or back outlet fitted with a collar for connection to the smoke pipe. An ample size removable, gasketed, pressure tight access panel shall be provided in the rear smoke box.



15B-5.16. Smoke Boxes-(Cont.)

Panel shall be located at the bottom of the smoke box when a rear smoke outlet is required, and at the back of the smoke box when a top smoke outlet is required. Where a rear smoke outlet is supplied, length of smoke box shall be at least 19-inches to provide access for expanding, rolling, and beading of the tubes. A fully gasketed, pressure-tight inspection door shall be located on both sides of the rear smoke box. One of these doors shall be fitted with a spring-equipped closing device to provide explosion relief. (In lieu of this location, the explosion relief door may be provided elsewhere on the boiler, as approved). The front smoke box shall be provided with doors as specified in Par. 15B-5.17.

15B-5.17. Doors

- (a) Each boiler shall be provided with cast iron or steel flue (smoke box) and inspection doors, complete with frames, locking devices, liners, etc. Doors and frames shall be designed so that the doors can be closed airtight. The use of ground or gasketed joints for this purpose is acceptable. Gaskets shall be of non-asbestos material, such as Carborundum Co.'s "Fiberfrax."
- (b) Flue doors shall be in two halves, hinged at the sides, and fitted with locking clamps. The following types of door construction are acceptable:
1. Cast iron door with a cast iron liner or with 1½-inch (minimum compressed thickness), fibrous glass wool blanket, suitable for 1000<sup>0</sup>F., covered with No. 12-gauge black sheet steel facing.
  2. Steel plate door of 3/16-inch minimum thickness, flanged on each side to form a pan with welded corners, and lined with 1-inch minimum thickness 1800<sup>0</sup>F. block insulation covered with No. 12-gauge black sheet steel pan.
  3. Steel plate door of ¼-inch minimum thickness, having 2-inch thick castable refractory insulation well anchored to the door and having a welded steel retaining bar about its periphery.
- (c) Provide a bolted cover type access opening in the rear wall, Cover shall be of cast iron, or of steel plate construction with castable refractory lining anchored to the cover. Opening shall be approximately 12-inches by 18-inches.

15B-5.18. Rings

Rings shall be provided for the bottom of water legs, for the oil burner opening, and for the inspection door. Water leg rings shall be installed as shown on the standard details, or as approved. Rings for other openings shall be constructed by means of a steel bar welded to the outer and inner sheets.

15B-5.19. Insulation Framing

Insulation framing of 1½ x 1/8-inch (minimum) steel shall be welded around all manholes, handholes, flue doors, inspection doors, access panels, smoke box inspection doors, at the bottom of the waterwalls, boiler number plate and boiler inspection stampings. In addition to these locations, an insulation frame extending from the front wall to the rear wall shall be welded to both sides of the boiler at a height of approximately 4-feet above the boiler floor. Framing shall be drilled at the factory to facilitate installation of the boiler insulation.

15B-5.20. Boiler Floor and Support

- (a) Each boiler shall be provided with a one-piece, ¼-inch thick steel floor plate continuously welded to the bottom of the mud legs. It shall be reinforced with steel cross ribs, welded to the floor plate. Skid type "I" or channel beams of 6-inch (minimum) height shall be welded to the bottom of the floor plate. These skid beams shall extend the full length of the shell, providing ample ventilation under the boilers.
- (b) The fire side of the mud legs and water walls, to a height of approximately 6-inches, and the interior surface of the floor shall be painted at the shop with one coat of red oxide paint.
- (c) A field installed refractory floor as specified in Par. 15B-4.11(b) shall be provided.

SECTION 15B-6  
BOILER TRIMMINGS

15B-6.00. Safety Valves

- (a) Provide and install a minimum of two (2) enclosed, spring loaded pop safety valves on each boiler. The steam relieving capacity of the valves shall be in accordance with the latest A.S.M.E. Code requirements, and with the capacities indicated on the drawings. Valves shall have the same, or nearly the same capacity. Safety valves shall be set and sealed to discharge at 15-pounds per square inch pressure. Seal shall be so attached to valve, that the seal must be broken before the valve can be disassembled. Each safety valve shall be built in accordance with the requirements of the latest A.S.M.E. Code.
  
- (b) Each steam safety valve shall be plainly marked by the manufacturer in such a way that the markings will not be obliterated in service. The markings may be stamped on the casing, or stamped or cast on a heavy plate securely fastened to the casing and shall contain the following markings:
  - 1. The name or identifying trade-mark of the manufacturer.
  - 2. Size in inches. (The pipe size of the valve inlet.)
  - 3. Pressure in pounds per square inch (steam pressure at which it is set to blow).
  - 4. Capacity in pounds of steam per hour.
  - 5. A.S.M.E. symbol.
  
- (c) A chain and pulley attachment to operate the lifting lever of the valve and a "gag" to prevent the operation of the valve during hydrostatic boiler test shall be provided. Each boiler safety valve shall also be provided with a 3/8-inch drain pipe connection embedded in the covering of the boiler and extended to a point near the floor.
  
- (d) Unless otherwise indicated on the drawings, safety valves shall be mounted on an extra heavy cast iron Y-base, J.E. Lonergans Co.'s Model YBF, or approved equal. The use of a Y-base constructed of standard weight steel pipe and standard weight cast iron fittings will also be accepted, provided that the cross-sectional areas of the pipes and fittings comply with A.S.M.E. requirements. Submit shop drawings.

15B-6.00. Safety Valves- (Cont.)

(e) Approved Makes

Safety valves shall be Kunkle Valve Co. Figure 183-7 or 930-1, or J.E. Lonergan Co. 15-W series (modified), or approved equal conforming to the requirements of the drawings and specifications. No safety valve will be approved unless it can be "gagged" for hydrostatic test of boiler without interfering with the valve setting and unless a suitable gag is furnished. Submit capacities at 15-pounds per square inch pressure, together with detail of gag for approval.

15B-6.01. Steam Gauges

- (a) Each boiler shall be provided with an 8½-inch dial pressure gauge having a cast aluminum case with a metal slip ring, and having a black baked enamel finish. Dial shall be graduated in one-pound increments from 0 to 30 pounds per square inch pressure, with black figures on a white background. Accuracy of gauge shall be guaranteed ½ of 1% of the scale range.
- (b) Gauge shall have bronze bourdon tube, bronze or brass socket and a geared movement of stainless steel or other approved metal. Tube and movement shall be mounted on a rigid socket. Movement shall not be attached to the back of the case.
- (c) Gauge shall be installed with a gauge-cock and a syphon, and as indicated on the Standard Detail. Piping for gauge shall be brass with malleable brass screw fittings.
- (d) Boiler steam gauges shall be of the best grade manufactured by Acme Gauge and Instrument Co., Ashcroft Gauge by Dresser Industries Inc., H.O. Trerice Co., Albert A. Weiss and Son, Inc. or Weksler Instruments Corp. Submit shop drawings for approval.

15B-6.02. Feed Pump Control and Low Water Cut-Off

- (a) Each oil fired boiler shall be equipped with a combined feed pump control and low water cut-off device installed on the boiler, which shall maintain a safe boiler water level by automatically opening a motorized valve which shall start the boiler feed pump whenever the water in the boiler drops to the minimum safe level. The device shall also stop the oil burner from operating should the water drop below the minimum safe level. All electric relays and wiring required for the proper installation and functioning of the boiler feed water system shall be furnished and installed by this Contractor. Refer to Paragraphs 15B-6.06 and 15B-14.00.

15B-6.02. Feed Pump Control and Low Water Cut-off

- (b) The feed pump control and low water cut-off shall be complete with an alloy metal float, magnetic switches, linkage, etc. contained in a cast iron or semi-steel housing, all factory assembled and shall be designed to operate on 120 volts A.C. The control shall be mounted on the boiler in the location shown on the drawings. Feed pump control and low water cut-off shall be No. 93-5 manufactured by McDonnell & Miller, Inc., or other approved equal.

15B-6.03. Secondary Low Water Cut-off

- (a) Furnish and install on each oil-fired boiler, in the location indicated on the drawing, a secondary low-water cut-off with manual reset. Secondary low water cut-off shall be set to function at a level approximately  $\frac{1}{2}$ -inch lower than the operating level of the primary cut-off specified in Par. 15B-6.02. It shall interrupt the oil burning process should the water level in the boiler drop below a safe level without actuating the primary cut-off. The secondary low water cut-off shall be so designed that electric power will not be restored to the oil burner until the manual reset button, located on the cut-off, has been activated.
- (b) Control shall be the electric probe type, designed for 120-volt operation. It shall be U.E. approved and shall be the equal of Hydrolevel Corp.'s Model LC967, installed in a Model LC1214-2 manifold. Control shall be installed complete with all necessary switches, relays, wiring, etc. Submit shop drawing for approval.

15B-6.04. Water Columns

- (a) Each boiler shall be equipped with an approved water column complete with gauge glass and fittings, try-cocks, etc.
- (b) Construction

Water column shall have a heavy cast iron or cast semi-steel body with bossed tappings for water gauge, three (3) try-cocks, and for steam, water, and blow-off connections. (See the standard details for sizes of piping.) Water gauge tappings shall be approximately 14-inches on centers. Gauge glass shall be 3/4-inch and red lined. Try cocks shall be 150-pounds per square inch rated, with bronze seat and metal disc. Tappings shall be not less than 3-inch on centers with the lowest try-cock approximately 3-inches above the center line of the lower gauge glass tapping. Gauge and try-cocks shall be equipped with wood wheels.

15B-6.04. Water Columns-(Cont.)

(c) Installation

Water columns shall be mounted on the boilers at locations shown on the standard details. Water column shall be mounted with the lowest visible part of the gauge glass 2-inches above top row of tubes. It shall have steam, water, and 3/4-inch valved blow-off connections. The water connection to boiler shall be not less than 6-inches below the center line of the boiler shell. Blow-off and drain piping shall be carried to within 18-inches of the boiler pit floor. Blow-off and drain piping shall be fastened to boiler with 1½ x ¼-inch steel brackets with ½-inch bolts. All drain and blow-off piping shall be brass and shall be made up with crosses, with the unused outlets having brass plugs.

(d) Approved Makes

Water columns shall be the equal of Clark-Reliance Corp. (No.1), conforming with the requirements of the drawings and specifications. Submit shop drawings for approval.

15B-6.05. Motor Operated Boiler Feed Valves

- (a) Furnish and install in the feed water piping to each boiler, in the location shown on the drawing, a motor operated valve which will be actuated by the feed pump control and low water cut-off specified in Par. 15B-6.02. The motor operated valve shall be equipped with an auxiliary switch which, through a relay, shall cause the feed pump to start when the valve is open and shall cause the feed pump to stop when the valve begins to close. Power supply to valve shall be wired to load side of feed pump disconnect switch.
- (b) Valve shall be single seated, 150 psi packed globe type, with bronze body and renewable seat and composition disc. Motor operator shall be of heavy duty design, with gear train completely submerged in oil. It shall be designed for 120-volt operation. Spring return motors are not acceptable. Cam operated limit switch shall be snap-acting, single-pole double throw type which shall stop the operator at the valve open and valve closed position.
- (c) Provide and install a single-pole double throw toggle switch in the top cover of valve motor housing. Switch shall be connected into the wiring circuit between the

15B-6.05 Motor Operated Boiler Feed Valves- (Cont.)

pump control and valve motor to effect the following: With the switch in the "Normal" position, the motorized valve will respond to the pump control, and with the switch in the "Closed" position, the motorized valve will close and will remain closed until the switch position is changed. Provide a suitably marked plastic nameplate at the switch.

- (d) Motor operated boiler feed valves shall be in accordance with the following:
1. Steel boilers having a waterside heating surface of 1250 square feet or less: 1-inch valve size, having a capacity index (Cv) of not less than 9. It shall be Barber-Colman's Model VC 2004 valve with No. OYBB 115-1-8 body, No. AV 335 linkage, and No. MC 431 motor with end switch; or Honeywell's Model V5011 A valve with No. Q618A1024 linkage, and No. M 644 B motor with Q607 end switch. Actuator shall be two-position type with 30-second (maximum) timing and 160° stroke. It shall have the ability to close against a pressure of at least 100 psi.
  2. Steel boilers having a waterside heating surface of more than 1250 square feet (but not more than 2500 square feet): 1½-inch valve size, having a capacity index (Cv) of not less than 16. Valve body, linkage and actuator shall be as specified in (d) 1.
  3. Cast iron boilers having a gross output of 7700 MBH or less: 1 inch valve size, having a capacity index (Cv) of not less than 9. It shall be Honeywell's Model V5011A valve with Q618A1024 linkage, and No. M944D motor with intergral switch and No. 130810B transformer. Equivalent proportion controlled motorized valve by Barber-Colman also is acceptable. Actuator shall have 30-second (maximum) timing and 160° stroke. It shall have the ability to close against a pressure of at least 100 psi.
  4. Cast iron boilers having a gross output over 7700 MBH (but not more than 15,500 MBH): 1½-inch valve size, having a capacity index (Cv) of not less than 16. Valve body, linkage and actuator shall be as specified in (d) 3.
- (e) Submit complete shop drawings for approval.

15B-6.06. Electric Wiring

All electric wiring between the boiler, feed pump controls, low water cut-offs, motor operated feed valves, oil burner control cabinet, and the boiler feed pump control cabinet shall be furnished and installed as part of the HVAC Contract.



SECTION 15B-7  
OIL BURNING EQUIPMENT

15B-7.00. General

(a) Scope

Furnish the labor, materials and equipment required for the installation of a complete system for the storage, heating, pumping and burning of No. 6 commercial grade fuel oil for the oil fired boilers, as indicated on the drawings. Each burner shall also be equipped to burn natural gas. The fuel burning system shall be capable of firing each boiler to produce the boiler's gross steam output, regardless of the fuel used. The system shall be set to burn No. 6 fuel oil initially but shall be capable of burning gas and No. 2 or No. 4 fuel oil at a future date by field installation of necessary controls and field modifications of the air-fuel ratios, and the oil metering and heating systems. The equipment shall include, but not be limited to, storage tanks, heaters, pumps, forced draft burners, burner windboxes, sequence dampers, controls, piping, wiring, fire extinguishers, gauges, thermometers, etc., all as specified, as shown on the drawings, or as is required for a complete installation.

(b) Rules, Permits, Etc.

1. HVAC Contractor shall obtain, without charge to the Board of Education, the permits required for work in connection with this installation from the Department of Buildings, Fire Department, Department of Environmental Protection (Air Resources), Department of Highways, and any other department having jurisdiction. All work and materials shall conform with the requirements of these departments.

Note: Contractor shall secure all permits before starting the work.

2. The Board of Education will prepare plans and obtain their approval from City agencies. It will also obtain approval of the "Oil Burner Equipment Application" (Building Department) and the "Fossil Fuel Combustion Equipment Application for Certificate of Operation", Form APC 5, (Department of Environmental Protection (Air Resources)).
3. As soon as the Contractor has placed his order for the oil burning equipment, he shall inform the Executive Director of the make, model number, etc. of each item of such equipment.

15B-7.00. General-(Cont.)

(c) Guarantee and Inspection

In addition to the terms of the guarantee provided for in Section 15B-1 and within the period covered therein, the Contractor shall inspect all parts of the system, etc., as often as necessary, and shall at all times within this period service the entire apparatus, etc. At the end of this period, another inspection shall be made and the entire system shall be left in perfect working order. The Contractor shall notify the Executive Director and the Custodian of the building when inspections as above called for are to be held.

(d) Installation and Adjustment

The entire equipment shall be installed under the direction of the manufacturer's representative and all necessary adjustment, alterations, etc., necessary to make the apparatus fully operative for the purposes intended, shall be made.

(e) Testing

1. The entire oil burning installation shall be in complete operation during the pressure and adjusting tests and cleaning-out operation specified in Paragraph 15B-1.39, and the installation shall be subject to the requirements of the entire paragraph.
2. Performance tests are required on the completed fuel oil burning installation. They shall be conducted in compliance with Part II of the Department of Environmental Protection's Engineering Criteria for Fuel Oil Burning Equipment, Latest Edition.

(f) Drawings

Drawings of the proposed oil burner installation showing the arrangement of the burners, piping, wiring, pumps and accessories shall be submitted and approved before installation is started. In addition, shop drawings of the following equipment shall also be submitted for approval: burners, pumps, heaters, tanks, controls, control cabinets, sequence dampers, draft inducers, strainers, valves, gauges, thermometers, damper motors, indicating instruments and safety devices.

15B-7.00. General-(Cont.)

(g) Piping and Wiring Diagram

A complete wiring diagram and piping layout of the oil burner system shall be framed and mounted where directed in the Boiler Room. Frame shall be of aluminum, satin finish, with one side of frame removable, and with a plywood backing. Single thick glass front shall be provided. All parts of the installation shall be indicated exactly as installed and shall be properly identified. Valve identification numbers shall agree with valve tags, and all piping shall be clearly shown. See Par. 15B-9.08.

(h) Certificate of Operation

At completion of the oil burning system installation work, Contractor shall obtain a "Certificate of Operation" from the Department of Environmental Protection (Air Resources) and shall deliver this certificate to the Executive Director before request for final payment is made.

15B-7.01. Burners

(a) Each burner shall be of the belt driven horizontal rotary cup type, with gas ring, arranged for automatic combustion of natural gas having a minimum content of 1,000 BTU per cubic foot, or of commercial grade No. 2, No. 4, or No. 6 fuel oil. The burner shall be complete with forced draft fan and windbox extension front, all factory fabricated. Each burner unit shall be equipped with burner motor and forced draft fan motor of required capacity, horsepower, etc. and with combination gas-oil burner face plate, nozzle shield, blanked gas flange, and provision for future field installation of primary air proving switch. The gas burner shall be of the multiple orifice nozzle mixing type.

(b) Burner shall be arranged to swing back out of opening in windbox extension front and shall be designed to stop the flow of oil automatically when burner is withdrawn from the opening. A suitable plug or blanking door shall be provided for each burner to close the burner opening when the burner has been removed. A quick-opening latch shall be provided to hold the burner securely in the burning position, tight against the burner front plate. Piping connections to burner shall be made through hinged joints, permitting the burner to be withdrawn from the extension front without disconnecting the oil piping.

15B-7.01. Burners-(Cont.)

- (c) Each burner unit shall be equipped with an integral forced draft fan of the multi-vane curved blade centrifugal type. Fan shall supply combustion air in proper quantity and pressure for the draft conditions available, and shall operate at a speed not exceeding 3450 rpm. Fan shall be provided with dampers, operated by the combustion control system by means of positive linkage.
- (d) Burners shall be provided with an integrally mounted, thermostatically controlled electric fuel oil heater, as specified in Par. 15-7.03.
- (e) The windbox extension front shall be provided by the burner manufacturer as an integral part of the oil burner unit. It shall be fabricated of not lighter than  $\frac{1}{4}$ -inch steel, substantially constructed to support the various burner components mounted on or within it, and shall be designed for proper assembly with the boiler front. The refractory lining of the windbox shall be furnished and installed by the burner manufacturer. Fire brick shall be as specified in Par. 15B-4.08, and plastic refractory shall be as specified in Par. 15B-4.10. Submit for approval complete, detailed shop drawings (to scale) of the proposed field integration of boiler and forced draft burner assembly.
- (f) Burners shall be S.T. Johnson Co.'s Model FDC-A53CHM, Preferred Utilities Manufacturing Corp. Model BHE-FD, or Ray Burner Co.'s FDC-BR-144 conforming to the requirements of the drawings and the specifications. Burners shall be U.L. listed and shall bear Listing Mark (A). They shall be acceptable to the Department of Environmental Protection (Air Resources).

15B-7.02. Motors for Oil Burners

- (a) Each forced draft oil burner unit shall be equipped with two (2) air-cooled, drip-proof induction motors. One motor shall supply power through a belt drive for both the rotary cup atomizer and for the atomizing air fan. The other motor shall supply power for the forced draft fan, which may be directly or belt driven. Motors shall be of size indicated on the drawings or as may be approved otherwise, and shall conform essentially to the requirements of Section 15B-16.

15B-7.02. Motors for Oil Burners-(Cont.)

- (b) Provide a drip pan, of size shown on the drawings, directly below each oil burner. It shall be 1-inch deep, and shall be fabricated of No. 20-gauge (minimum) galvanized sheet steel.

15B-7.03. Electrical Oil Heater on Burner

- (a) Each oil burner shall be equipped with an electric immersion oil heater of size indicated on the drawings. Heater shall be low density type, with no more than 12-watts per square inch of blade surface. It shall have three elements and shall be designed for 3-phase, balanced across-the-line operation. Heater shall be equipped with thermostatic control, a dial type thermometer, a neon glow lamp to indicate when heater is energized, and a 3-pole three-phase magnetically held contactor for 208-volt service. Means to relieve excess pressure in the heater shall be provided.
- (b) Thermostatic control shall disconnect current when oil temperature setting is reached. It shall also prevent the oil valve from opening unless the oil is at the proper temperature. A circuit breaker in the oil burner control cabinet shall also control the oil heater.
- (c) Heating element shall be manufactured by Vulcan Electric Co., Wells Manufacturing Corp., E.L. Wiegand Co.'s Chromalox or other approved equal.

15B-7.04. Strainers (Oil Burner)

Furnish and install a single strainer in the oil supply close to each burner (ahead of the magnetic oil valve) in an accessible location. Strainer basket shall be of brass or copper mesh installed in a heavy gray cast-iron body or chamber. Chamber shall be provided with an easily removable cover, screwed or yoke fastened at the top, and with a plugged, large size drain at the bottom. Strainers shall be designed for operation on pressures up to 15-pounds per square inch and tested hydrostatically at 250-pounds per square inch. Strainers shall be of the highest grade manufactured by Hayward Manufacturing Co., Kraissl Co., Preferred Utilities Mfg. Corp., Ray Burner Co. or other equal, all as approved.

15B-7.05. Gauges

Provide and install a pressure gauge at each oil burner, and a pressure gauge and a vacuum gauge at each pump and heater set. Each gauge shall be not less than 2-inches in diameter and shall have bronze seamless bourdon tube with brass or bronze movement. The case shall be of steel or cast aluminum, with black enamel finish. Gauge at oil burner shall be graduated from 0 to 160-pounds per square inch. At the fuel oil pump and heater set, a pressure gauge graduated from 0 to 60-pounds per square inch shall be installed at the oil pumps' discharge; a vacuum gauge graduated from 0 to 30-inches of mercury shall be installed at the outlet of the duplex strainer. Gauges shall be manufactured by H.O. Trerice Co., Marshalltown Mfg. Co., U.S. Gauge, Albert A. Weiss & Son, Inc., Weksler Instrument Corp. or other approved.

15B-7.06. Thermometers

Furnish and install thermometers at each oil burner and at the inlet and discharge of the pump and heater set. Thermometers shall be bi-metal dial type 2½-inch (minimum) diameter with non-ferrous metal or stainless steel rings or casings, graduated approximately 30<sup>0</sup> to 240<sup>0</sup>F. Thermometers shall be as manufactured by Ashcroft, Marshalltown Mfg. Co., Moeller Instrument Co., H.O. Trerice Co., Albert A. Weiss & Son, Inc., Weksler Instrument Corp. or other approved.

15B-7.07. Relief Valves

Provide and install relief valves in the oil piping where shown on the drawings and where otherwise required. Each relief valve shall be equipped with a locking device to prevent vibration from disturbing the setting after initial adjustment has been made.

15B-7.08. Burner Controls

(a) General

Furnish and install all the controls, including the protective and modulating flame control devices, required for the economical and safe operation of the oil burning equipment, as specified and as required. HVAC Contractor shall provide the electric wiring for the burner controls, except where otherwise specified. Refer to Par. 15B-7.23. Safety devices, including pressure controls, combustion controls, relays, etc., shall have their electric switching mechanism connected to an ungrounded conductor or conductors.

15B-7.08. Burner Controls-(Cont.)

1. Controls for each oil burner shall include automatic gas-electric ignition with magnetic gas valve, ignition transformer, electronic flame failure programming control, safety devices, etc. Burners shall operate on a low-high - low-off cycle, at predetermined maximum and minimum boiler pressures. Gas piping, sensing devices, transformers, relays, switches and other accessories required to make the burner system operative, shall be furnished and installed.
2. Ignition transformer, solenoid pilot gas valve, burner motor twist lock, electric heater twist lock and modutrol motor transformer shall be mounted in a completely enclosed Underwriter's approved cabinet on the burner chassis. Modutrol motor shall be mounted on top of the cabinet. This equipment shall be completely factory wired to a terminal strip for connection to terminal strips of control cabinet specified in Par. 15B-7.09. Alternate methods of mounting this equipment shall be submitted for approval.
3. Modulating flame control mechanism for each burner shall consist of a modulating electric damper control motor, modulating pressure controller, metering device, linkage, etc., so that the atomizing and combustion air dampers and the metering device will be actuated by the modulating motor controlled by the modulating controller.
4. Each system shall also be equipped with a flame failure control, low water cut-off, pressure operating control, pressure limit control, outside air intake damper control, magnetic oil valve, sequence draft control, etc.
5. Multiple boiler installations shall be provided with a lead-lag programming control as specified in Par. 15B-7.13.
6. In general each control unit shall be a standard catalog product of the manufacturer, and shall be of a type embodying the latest improvements. It shall be installed in accordance with the manufacturer's instructions.

15B-7.08. Burner Controls-(Cont.)

(b) Solenoid Valves

Each burner shall be provided with a 120-volt normally closed, packless solenoid valve in the oil supply and in the pilot gas supply. The oil valve shall be wired through an auxiliary contact of the burner motor starter and into the burner programming circuit, so that the valve will open only when the gas pilot flame has been proven and will remain open until the steam demand has been satisfied, unless flame failure occurs. The pilot gas valve shall be wired into the burner programming circuit to open only at the end of the pre-purge period and to remain open until the main (oil) flame has been proven. Both valves shall be U.L. approved, and, in addition, the gas valve shall be approved by the American Gas Association. Each solenoid valve shall be manufactured by Automatic Switch Co. (ASCO), Honeywell, ITT General Controls Co., or other approved equal. The solenoid oil valve shall be designated by the manufacturer for use with No. 6 (or other specified grade) fuel oil at the pressure and temperature of this system. The solenoid pilot gas valve shall be designated by the manufacturer for use with natural gas at the pressure furnished. Submit shop drawings.

(c) Metering Device

Each burner unit shall be equipped with an approved metering oil pump which will deliver a constant volume of fuel oil to the burner regardless of change in oil viscosity or in oil line pressure. The metering device shall be designed so that its maximum delivery rate will be fixed so as not to exceed the required firing rate of the burner. The metering device shall indicate the actual burner oil delivery rate in gallons per hour at the required firing rate, and in fractions thereof at lower firing rates.

(d) Modulating Motor

Furnish and install a potentiometer type reversing motor to operate the atomizing air damper, the combustion air damper and the metering device. Motor shall be Honeywell's Type M941D, or equal, having a continuous load rating of not less than 80-inch pounds for 60-seconds timing with a current consumption of not more than 24-watts when running and 3-watts when standing by. The casing of the motor shall be oil tight and all moving parts shall operate in an oil bath. The modulating motor shall be connected into the



15B-7.08. Burner Controls-(Cont.)

circuit of the oil burner motor ahead of the magnetic starter. Positive linkage shall be used between the motor lever arm and the atomizing air and combustion air dampers so that the dampers will be opened and closed to maintain proper combustion as the oil flow is varied. The modulating motor shall be equipped with a high-fire switch to prove that the motor has moved to the high-fire position during the pre-purge period, and with a low-fire switch to prevent burner ignition unless the modulating motor is at the low-fire position.

(e) Modulating Controller

On each boiler, furnish and install a modulating controller, the approved equal of Honeywell's L91B, and electrically connect it into the circuit of the modulating motor. Connect the controller to the boiler so that varying boiler pressures will actuate the controller which in turn will actuate the modulating motor, so as to maintain practically constant steam pressure. Piping connection shall include a syphon and shall be installed as shown on the Standard Details.

(f) Pressure Operating Control

1. Provide and install on each boiler a pressure operating control, which shall be installed with syphon as indicated on the Standard Details. Control shall be equipped with automatic reset feature, and shall be Honeywell's Pressuretrol Model L404A or Mercoid Corp. Series D-30 type DA-31. Operating control shall function to stop the operation of the oil burner when the boiler pressure reaches 8 PSIG and to cause the burner to start when the pressure drops to a selected lower pressure.
2. When the lead-lag programming control, specified in Par. 15B-7.13, requires a pressure control installed on the steam header, it shall be in addition to the control installed on the boiler and shall be one of the makes specified in (f)1. In this case, the control installed on the header shall act as the primary operating control, and shall be set in accordance with the recommendation of the lead-lag control manufacturer. The pressure operating controls installed on the boilers shall all be set alike: cut-out pressure not to exceed 8 PSIG; cut-in pressure at a pressure lower (approximately 1 PSIG) than the header (lead-lag) control cut-in pressure.

15B-7.08 Burner Controls - (Cont.)

(g) Pressure Limit Control

Furnish and install on each boiler a pressure limit control, wired in series with all other control devices to the ungrounded conductor, to stop the burner and to interrupt completely the power to the flame failure control if the boiler pressure exceeds 12 PSIG maximum. Control shall be installed with a syphon, as indicated on the Standard Details. It shall be equipped with manual reset feature and shall be Honeywell's Model LA04C or LA079B, or Mercoind Corp. Series DR Type DR-31.

(h) Flame Failure Control

1. Each oil burner shall be provided with a flame failure (combustion safety) programming control which will de-energize all electrically operated fuel valves and burner equipment within four seconds, and actuate a visual alarm (bull's eye) mounted on the control panel after an operating flame failure has occurred. Automatic start up and shutdown programming shall be a part of this safety equipment.
2. Pilot and main flame shall be detected by a lead sulphide or ultraviolet scanner, or the pilot shall be detected by a flame rod (rectifier) and the main flame by a photo cell. Scanner shall be so located as not to be actuated by hot refractory or other hot body.
3. Control shall provide for prepurge (30-seconds minimum) prior to light off, proof of pilot before main fuel valve opens, proof of main flame only during run, and post purge (10-seconds minimum) at the end of each firing period. Control shall effect a safety shutdown prior to the opening of the main fuel valve if the presence of the pilot flame has not been proven.
4. In case of electrical power supply failure, control shall recycle automatically when power is restored. In case of safety shutdown, control shall not permit recycling of the burner equipment until after the manual operation of a reset button.
5. Flame failure control for each burner shall be installed in the control cabinet.

15B-7.08. Burner Controls-(Cont.)

6. See Paragraph 15B-7.23 for electric wiring, etc.
7. Controls shall be "Fireye" Type D10 Model 5022, Honeywell's R4140L with R7248 self-check amplifier, or other approved equal.
8. Submit complete shop drawings for approval.

(i) Low Water Cut-offs

The low water cut-offs specified in Par. 15B-6.02 and 15B-6.03 shall be so wired and so connected into the oil burner motor circuit that the motor will be de-energized in case of low water within the boiler.

15B-7.09. Control Cabinet

- (a) 1. Provide and install an enclosed control cabinet for each oil burner, in the location shown on the drawing. Cabinet shall be made of No. 12-gauge (minimum) sheet steel and shall be in accordance with N.Y.C. Electrical Code requirements. It shall be completely factory fabricated, wired and tested. Cabinet shall be provided with a flush mounted sheet steel door(s), set in a rabbeted frame, which shall provide access to the equipment, wiring, etc. installed within it. Door(s) shall have turned edge reinforcement and be complete with piano type hinges, which shall be screwed to the cabinet frame for easy removability. Door shall have three point latch to provide positive closure and a cylinder type lock. A complete door gasket shall be provided. Four (4) keys shall be furnished and delivered to the Custodian.
2. Cabinet shall be designed so that the bottom of the enclosure is not less than 6-inches above the level of the boiler pit floor and shall be mounted on a metal base or legs and made self supporting. (When the boiler pit floor is of waterproof construction, fastening of cabinet supports to floor shall be made in a manner that will not damage the waterproofing.) Knockouts or openings for electric conduits shall be located in the side of the cabinet (adjacent to boiler) near terminal strip. Exterior surfaces of the cabinet shall be primed and finished in gray machine enamel. Interior surfaces shall be left unpainted. A building trades union label shall be fastened inside the cabinet.

15B-7.09. Control Cabinet-(Cont.)

- (b) In each control cabinet, the following equipment shall be assembled, connected, and wired. In addition, space shall be provided for future field installation of a manual fuel selector switch, primary air proving interlock, and automatic fuel changeover relay. All control circuit wiring to burners and related equipment shall be designed for 120-volt operation.
1. Flame failure (combustion safety) control.
  2. Draft gauge (flush mounted).
  3. Flue gas temperature indicator (flush mounted).
  4. Smoke indicator (flush mounted) and alarm bell (wired to terminal strip within cabinet).
  5. Draft sequence controller (flush mounted).
  6. Magnetic starters for burner motor and forced draft fan motor. (Interlock burner motor starter with outside air damper motor end switch).
  7. Control circuit switch.
  8. 3-pole circuit breakers for burner motor and forced draft fan motor.
  9. 3-pole circuit breaker for electric heater.
  10. Terminal block or strip.
  11. Control circuit fuse block.
  12. Outside air damper motor fuse block.
- (c) The draft sequence controller and all indicating instruments, lights, circuit breakers and manual switches shall be flush mounted in the upper part of the control cabinet so that they are visible and operable from the front (side facing burner) of the cabinet. A removable gasketed panel, set in a rabbeted frame, shall provide access to the rear of all flush mounted devices.
- (d) Non-ferrous metal or plastic laminate nameplates with letters not less than 3/16-inch high shall be provided on the exterior of the cabinet to identify the devices operated from outside, and on the interior to identify the various circuits and devices located inside the cabinet.

15B-7.09. Control Cabinet-(Cont.)

- (e) A complete wiring diagram as approved and installed shall be secured to the inside of the cabinet door.
- (f) All wiring within the cabinet shall be in accordance with the recommendations of the manufacturer, with the N.Y.C. Electrical Code and with Bulletin No. 8, 1963 of the Department of Water Supply, Gas and Electricity. Circuit breakers, motor starters, contactors, etc. shall comply with NEMA standards.
- (g) The circuit breaker for the burner and forced draft fan motor shall be a Westinghouse (Type E-100 ampere frame), Heinemann, General Electric or equal general purpose 240-volts 3-pole automatic breaker with 3-pole overload coils and proper rating and tripping time delay specifications for the conductors and motor protected by the device.
- (h) The circuit breaker for the electric heater shall be a Westinghouse (Type E-100 ampere frame), Heinemann, General Electric or equal general purpose 240-volt 3-pole automatic breaker with 3-pole overload coil with thermal magnetic trip. The circuit breaker shall be rated to protect the heater and conductors protected by the device, and shall be provided with an interlocking wiring arrangement so that burner control circuit is open until the electric heating circuit is closed.
- (i) The flame failure (combustion safety) control shall be as specified in Par. 15-7.08(h).
- (j) The motor starters shall be Allen Bradley Bulletin 709, Square "D" Class 8536, or other approved equal. They shall be size 0 for motors up to and including 2 HP, and size 1 for motors of 3 to 5 HP inclusive, line voltage magnetic starters providing voltage failure protection and overload protection in each leg.
- (k) Provide main line terminal lugs for connections of 3-phase service feeder by others.
- (l) Submit detailed shop drawings of the control cabinet together with a complete wiring diagram for approval.

15B-7.10. Draft Gauges

- (a) Furnish a draft gauge for each boiler and install it in the oil burner control cabinet. Gauge shall be of the dry diaphragm type, with calibration by means of a beryllium copper spring having permanent tension characteristics. It shall have accessible zero adjustment pivots of stainless steel. Draft gauge dial shall be graduated in increments of 0.01-inch W.C. and shall have a range of -0.4 to + 1.0 inch W.C.
- (b) Connect a 1¼-inch tee to the draft sampling tube provided in the boiler wall. From the top of this tee, furnish and install type K hard copper tubing connecting with the oil burner control cabinet, with branches to the draft gauge and to the draft sequence controller. Install a plug in the unused opening of the tee at the boiler wall. Size of tubing shall be as recommended by the instrument manufacturer. Provide a 3-way cock at the draft gauge for purge and test purposes.
- (c) Draft gauge shall be Cleveland Controls, Inc. Model PG-C4, Preferred Instruments Model JC21F41, or equal. The draft switch with time delay relay specified in Par. 15B-7.14 (c) may be combined with the draft gauge. Preferred Instruments Model JC21F41C3, or equal, is acceptable for this purpose. Submit shop drawings for approval.

15B-7.11. Flue Gas Temperature Indicators

Furnish and install a thermocouple type flue gas temperature indicator for each boiler. Thermocouple shall be located on the boiler smoke box, and the indicator shall be flush mounted in the oil burner control cabinet. Temperature scale shall be graduated in 25-degree increments, from 0<sup>0</sup>F. to approximately 1000<sup>0</sup>F. Excess thermocouple wire shall be coiled and secured within the control cabinet. Installation shall be made in accordance with the manufacturer's instructions. Flue gas temperature indicators shall be Cleveland Controls, Inc. Model FG-FM, Preferred Instruments Model JCl1F or approved equal. Submit shop drawings for approval.

15B-7.12. Smoke Indicators

- (a) Furnish and install a system of smoke indicating equipment for each boiler. Equipment shall include a light source, a photoelectric receiver, an indicator unit and an alarm bell. System shall instantly detect any change in smoke density from the best combustion point setting and indicate the change on a meter. The emission of smoke equal to or

15B-7.12. Smoke Indicators-(Cont.)

greater than No. 1 Ringelmann shall activate a flashing red light on the indicator and cause the alarm bell to sound. In the event of failure of the light source, the signaling devices shall be activated and shall operate until the manual reset device has been used.

- (b) In addition to activating the signaling devices, the smoke indicator shall shut down the oil burner within two minutes of continuous emission of smoke of a density equal to or greater than No. 1. The combustion shutdown shall be so designed that once it has been activated, the burner cannot resume operation without manual reset of the smoke indicator.
- (c) The indicator case shall be constructed of heavy gauge steel or of cast aluminum with a hinged door at the front, secured with a lock or catch. It shall be flush mounted in the upper part of the oil burner control cabinet. The indicator meter shall be graduated in Ringelmann numbers. A white or a green light on the indicator shall be used to indicate acceptable smoke density. The flashing red light on the indicator shall indicate excessive smoke density.
- (d) The light source and photoelectric receiver unit shall be mounted on opposite sides of the boiler smoke box in exact visual alignment. Each shall be contained in an aluminum or a steel dustproof housing. Provide and install pressure caps for smoke box openings. Pressure caps and their lenses shall be easily removable for cleaning.
- (e) The receiver unit shall be equipped with a metal grid or equivalent filter, calibrated so that when placed in the light path, it will cause a response equivalent to that caused by smoke of No. 1 Ringelmann density. This calibration shall be marked on the grid holder or frame. The grid shall be securely fastened to the housing of the receiver unit by means of welded link chain of suitable length. Provision shall be made to hang the grid temporarily in front of the receiver unit to facilitate adjustment of the light and calibration of the indicating system.
- (f) The alarm bell shall be at least 4-inches in diameter, of the vibrating type, with underdome construction. It shall be installed on the side or the back of the oil burner control cabinet. When shown on the drawings, furnish and install a remote smoke alarm (both

15B-7.12. Smoke Indicators-(Cont.)

audible and visual) in the Custodian's Workshop. This alarm shall indicate excess smoke condition occurring in any of the boilers.

- (g) HVAC Contractor shall provide and install the electric wiring connecting the indicator unit in the control cabinet, the light source and the photoelectric receiver unit, as well as the remote alarm.
- (h) Smoke indicators shall be Cleveland Controls, Inc. Model CSI-RS-2, Honeywell Model Y513A, Preferred Instruments Model JC30F4D2FX or Reliance Instrument Mfg. Corp. Model PIC-101T, conforming to the requirements of the specifications. Submit shop drawings for approval.

15B-7.13. Lead-Lag Programming Control

- (a) Furnish and install a lead-lag programming control to sequence automatically the firing of the boilers in balance with changing load conditions. The sequence for start-up and operation shall be such that the first (lead) boiler starts-up and reaches its burner oil delivery (high fire) rate. If the first boiler is unable to meet the steam pressure demand, the second (lag) boiler shall automatically fire. (On a three-boiler installation, the two lag boilers shall be automatically alternated with each call for operation.) Both boilers shall operate in unison, modulating to meet the demand. If the demand is exceeded by both boilers firing at low fire, the lag boiler shall automatically shut down. The lead boiler shall shut down when the demand has been exceeded. Selection of the lead boiler shall be made either manually by means of a selector dial on the control cabinet or automatically as an electrical function of the programming control. Control cabinet shall be wall mounted in the location shown on the drawing.
- (b) The lead-lag programming control installation shall be made complete in all respects, with required pressure controls, wiring, sampling tube, etc. provided by this Contractor. Lead-lag programming control shall be Cleveland Controls, Inc. Series CMM-H, Preferred Instruments Model JC-CDDF-2A (for two boilers), or JC-CDDF-3 (for three boilers), or other approved equal. Submit shop drawings for approval.



15B-7.14. Draft Sequence Controller

- (a) Provide and install a draft sequence controller for each boiler and locate it in the oil burner control cabinet. The controller shall activate the various items of combustion equipment in proper sequence so as to establish automatic draft modulation and to maintain the predetermined most efficient setting of the damper. It shall also close the damper when the oil burner is shut down. Draft controller shall comply with the requirements of the Department of Environmental Protection's "Engineering Criteria for Fuel Burning Equipment", latest edition.
- (b) Controller shall include a manual selector switch, an emergency open damper switch, indicator light, and all relays required for full programming. It shall automatically maintain the over-fire draft within 0.01 W.C. of the draft switch setting. The controller circuit shall interconnect with the flame failure and limit control circuits governing burner operation to provide adjustable damper opening for prepurge and safe starting ignition, full modulation of damper during firing, open damper during post purge, and closed damper after boiler shutdown. The selector switch shall provide a means of manually positioning the damper for test or emergency purposes.
- (c) An excess pressure draft cut-off switch shall shut down the system in the event of an unsafe draft condition in the firebox lasting more than five seconds. After safe draft is re-established, the combustion control system shall recycle from the original starting position. Excess pressure draft switch may be incorporated in the draft gauge; refer to Par. 15B-7.10 (c). Draft sequence controller shall be Cleveland Controls Inc. Model DCR-AS-DS-PP-E, Preferred Instruments Model JC60F11A2B1 PP-DP, or other approved equal conforming with the requirements of the specifications.
- (d) The draft sequence control system shall be installed, tested and adjusted in accordance with the recommendations of the manufacturer. Submit complete shop drawings, including wiring diagrams, for approval.

15B-7.15. Automatic Damper Actuator

- (a) Furnish and install an automatic actuator of the linear acting type for each sequence damper located in the boiler smoke breeching. Actuator shall have sufficient power to open and close a damper, equal to a 100-pound weight, continuously without overloading. Motor shall be equipped with safety and limit switches and with permanently lubricated, sealed ball bearings. Damper actuator shall be totally enclosed in a dust-tight casing and shall be provided with mounting brackets.
- (b) Installation position (vertical or horizontal) of actuator shall be in accordance with manufacturer's recommendation. A 1/8-inch (minimum thickness) heat insulating gasket of non-asbestos material shall be installed between the actuator brackets and the breeching support.
- (c) Automatic damper actuator shall be Cleveland Controls, Inc. Model LF-AS-E, Preferred Instruments No. PL-2, or other approved equal conforming with the requirements of this specification and approved by the New York City Board of Standards and Appeals. Submit shop drawings for approval. For damper specification, see Para. 15B-17.29 (e).

15B-7.16. Sequence of Operation

- (a) During the period when there is no call for burner operation by the boiler pressure operating control, the breeching damper shall be maintained in the safe closed position. Safe closed position shall be understood to mean that the damper blade shafts have been rotated approximately 70 degrees from the fully open position.
- (b) When the boiler pressure operating control calls for burner operation, the following sequence of operation shall take place:
  - 1. Breeching damper shall move to safe starting position, which shall be adjustable in the field. Forced draft fan and, where provided, induced draft fan shall start. After 30-second (minimum) pre-purge period, safe starting draft must be proven in combustion chamber before light off can take place.
  - 2. Forced draft fan and induced draft fan shall be controlled through auxiliary fan relay in burner control panel.

15B-7.16. Sequence of Operation-(Cont.)

3. As soon as safe starting draft is established, the flame failure control shall go through normal sequence of pilot ignition, pilot proving, main flame ignition and proving. When main flame is proved, draft controller shall modulate to maintain constant combustion chamber draft, within .01" W.C. of adjustable setting, regardless of firing rate or atmospheric conditions.
4. When boiler pressure operating control is satisfied, flame failure control shall de-energize the oil solenoid valve, shutting off main flame. Forced draft fan and induced draft fan shall continue to run for 10-second (minimum) post purge period. During this period, breeching damper shall remain open to permit venting of gases. After completion of post purge period, breeching damper shall move to safe closed position.
5. At any time during an operating cycle, if the draft in the combustion chamber should fail for any reason, a signal light in the draft controller shall so indicate and if draft is not re-established within 5 to 7 seconds, the burner shall be shut down.
6. In case of flame failure, burner shall shut down and breeching damper shall move to safe starting position to permit venting of unburned gases. Burner and fan motors shall shut down with burner lockout. Draft sequence controller shall re-cycle after reset of flame failure control.
7. In case of a power failure or any other cause of shut-down, the breeching damper shall move to the safe starting position before the burner can be started.

15B-7.17. Pump and Heater Set

- (a) Furnish and install in the location shown on the drawings a factory-assembled package type pump and heater set. Assembled on a structural steel stand shall be the following equipment:
  1. Two fuel oil pumps with motors
  2. One steam oil heater
  3. Electric oil heaters with integral thermostats (quantity and capacity as indicated on drawings)
  4. One duplex oil strainer
  5. One vacuum gauge (at outlet of strainer)

15B-7.17. Pump and Heater Set-(Cont.)

6. One pressure gauge (at pumps' discharge)
  7. Two oil thermometers (one at the pumps' inlet, and one in the discharge of the pump and heater set)
  8. Three relief valves (one at the pumps' discharge, one at the electric heating system discharge, and one at the steam heating system discharge)
  9. One thermostatic temperature regulator for the steam heating coil, with steam strainer, three-valve bypass, and float-thermostatic trap
  10. High limit oil temperature control (at discharge of pump and heater set)
  11. High limit oil pressure switch (at discharge of pump and heater set)
  12. Pre-wired control cabinet (as specified in Par. (g))
- (b) Pump and heater sets shall be completely piped, valved, wired, and ready for oil suction and discharge connections, and steam and electric service connections. Unit shall be capable of delivering the amount of oil required at 50 psi discharge pressure with only one pump operating. Pump and heater sizes indicated on the drawings are minimum. In the discharge piping of the set, provide and install a high limit switch, the approved equal of Honeywell's L404C1121, which shall be manual reset type with a pressure range of 10-150 psi. Switch shall be provided with a stainless steel diaphragm, and shall be installed with a ¼-inch siphon. Switch shall be wired into the pump and heater control circuit so that power to the pumps will cease in the event of excess oil pressure.
- (c) The electric and steam heating systems shall be in series, but shall be so piped, valved, and wired that either, neither, or both heating systems may be used. Electric and steam heaters shall be approved by the N.Y.C. Board of Standards and Appeals.
1. Each electric heater shall be of the 3 element manifold type, with not more than 12-watts per square inch of blade surface. Each electric heater shall be controlled by its own circuit breaker, contactor, and integral thermostat (set at approximately 130°F.) A signal light shall be

15B-7.17. Pump and Heater Set--(Cont.)

provided for each electric heater and shall be wired through an auxiliary contact in the heater contactor to indicate when the heater is energized. All electric heaters shall also be controlled by a high limit thermostat set at approximately 180°F, located in the discharge piping from the electric heating system. Thermostats shall be adjustable for the temperature range to be encountered. Heaters shall be designed to operate on 3-phase, 208-volt service. Electric heater load shall be equally distributed among the three phases. Circuit breakers shall be 3-pole, Westinghouse minimum FA frame or equal by General Electric, Heineman, or ITE, of sufficient trip size to protect equipment and wiring. Contactors shall be 3-pole, the approved equal of Allen-Bradley 702, Furnas Class 40, Square D class 8502. Size of contactor shall be rated not less than 120% of the ampere rating of the heater. Interlock wiring shall be provided so that the electric heaters will be energized only when an oil pump is operating.

2. The steam heating system shall be capable of a 60°F. temperature rise in the amount of oil required. The steam heater shall be automatically controlled by one of two single seated thermostatic temperature regulating valves. One valve shall have a range of 100°-140°F., and the second valve shall have a range of 140°-180°F. These valves shall be piped to supply parallel paths of steam flow to the fuel oil heater. A Y-type strainer shall be installed in the steam line ahead of the regulating valve assembly. Provide a gate valve before each regulating valve (two gate valves required). Install a three-way, two port bronze plug cock after the steam regulating valves (before the heater). It shall be so piped that only one of the regulating valves can supply steam to the heater at a time. Provide a full size globe valved by-pass around the regulating valve assembly. Also provide a 1-inch gate valved blowdown connection, piped from the heater's steam inlet to within 12-inches of the floor.
3. Furnish and install a float and thermostatic trap in the condensate connection from the heater. Condensation from the heater shall be wasted to a funnel connection provided by the Plumbing and Drainage Contractor.

15B-7.17. Pump and Heater Set-(Cont.)

4. Thermostatic temperature regulating valves shall be as specified in Par. 15B-10.02. Gate valves shall be O.S. & Y. type. Those in the regulating valve assembly shall be the full line size of the regulating valves. Three-way cock shall be the equal of Lunkenheimer's Figure 1235, with lever.
- (d) Fuel oil pumps shall be manufactured by DeLaval Turbine Co. (Imo Pump), Viking Pump Division of Houdaille Industries, Inc., Kraissl Co., Inc., Preferred Utilities Manufacturing Corp. (Nitaloy Pump), Worthington Pump Co. (Gami Pump), or other approved equal. Each pump motor shall be provided with a circuit breaker and with a magnetic type motor starter. Circuit breakers shall be as specified in (b)1. Starters shall be Allen-Bradley Bulletin 709, Cutler-Hammer 9586, Square D Class 8536 (or other approved equal) size 0 for motors 2 HP or less. Pump selector switch shall operate so that power to the non-operating motor starter is disconnected when its circuit breaker is tripped.
- (e) In addition to the foregoing, each pump and each electric heater shall be provided with protective and disconnecting devices and wiring to comply with N.Y. City regulations and codes. Circuit breakers, contactors, motor starters, etc. shall comply with NEMA standards, and shall be UL approved.
- (f) Gauges, thermometers, and relief valves shall be as specified in Paragraphs 15B-7.05, 15B-7.06, and 15B-7.07. Gauges, thermometers, control cabinet, etc. shall be oriented to the front (side away from wall) of pump and heater set. See drawings.
- (g) Pump and heater set shall be installed on a 4-inch high concrete base, furnished by this Contractor.
- (h) 1. A galvanized or cadmium plated steel control cabinet not lighter than No. 14-gauge with hinged front door shall be mounted on the pump and heater set. Hinges shall be heavy duty with removable pins. All indicating lights and switches shall be installed on the outside of the front face of the cabinet. Each item of control equipment shall be identified by engraved laminated plastic name plates. Cutouts shall be provided in the door to operate the circuit breakers and the motor starter resets. A wiring diagram of the pump and heater set shall be mounted on the interior surface of the cabinet door.

15B-7.17. Pump and Heater Set-(Cont.)

2. The control cabinet shall contain the following equipment, all factory wired, as well as other necessary hardware and devices:
  - A. 3-pole circuit breaker for each electric heater
  - B. 3-pole contactor for each electric heater
  - C. 3-pole circuit breaker for each oil pump motor
  - D. Magnetic starter for each pump motor
  - E. Pump selector switch (double pole, double throw)
  - F. Signal light for each electric heater
  - G. Control circuit fuse block (single pole)
  - H. Control circuit switch
  - I. High limit oil temperature switch
  - J. High limit oil pressure switch
  - K. 4-pole power supply terminal block
  - L. Required number of terminals to wire all necessary external components
3. Exterior of cabinet shall be finished in gray enamel. Cabinet shall bear a building trades union label. Details of cabinet shall be shown on shop drawings submitted for the pump and heater set.
  - (i) Pump and heater set shall be of the highest grade manufactured by H. Liebllich & Co., Preferred Utilities Manufacturing Corp., Ray Burner Co., or other approved manufacturer complying with the requirements of the specifications and the drawings. Submit shop drawings for approval.

15B-7.18. Transfer Pump Set

- (a) Where shown on the drawings, furnish and install a factory-assembled, package type fuel oil transfer pump set. Assembled on a structural steel or cast iron base shall be the following:
  1. Two fuel oil pumps with motors.
  2. One duplex oil strainer.

15B-7.18. Transfer Pump Set-(Cont.)

3. One vacuum gauge (at outlet of strainer).
  4. One thermometer (at outlet of strainer).
  5. Two pressure gauges (one at each pump discharge).
  6. Two relief valves (one at each pump discharge).
  7. High limit oil pressure switch (at discharge of pump set).
  8. Pre-wired control cabinet (as specified in Par. (g) ).
- (b) Pump sets shall be completely piped, valved, wired and ready for oil suction and discharge connections and electric service connections. Unit shall be capable of delivering the amount of oil required at 50 psi discharge pressure with only one pump operating. Pump sizes indicated on drawings are minimum. In the discharge piping of the set, provide and install a high limit switch, the approved equal of Honeywell's L404C1121, which shall be manual reset type with a pressure range of 10-150 psi. Switch shall be provided with a stainless steel diaphragm, and shall be installed with a  $\frac{1}{4}$  inch siphon. Switch shall be wired into the pump control circuit so that power to the pumps will cease in the event of excess oil pressure.
- (c) Fuel oil pumps shall be manufactured by DeLaval Turbine Co. (Imo Pump), Viking Pump Division of Houdaille Industries, Inc., Kraissl Co., Inc., Preferred Utilities Manufacturing Corp. (Nitraloy Pump), Worthington Pump Co. (Gami Pump), or other approved equal. Each pump motor shall be provided with a circuit breaker and with a magnetic type motor starter. Circuit breakers shall 3-pole, Westinghouse minimum FA frame or equal by General Electric, Heine-man, or ITE, and of sufficient trip size to protect equipment and wiring. Starters shall be Allen-Bradley Bulletin 709, Cutler-Hammer 9586, Square D Class 8536 (or other approved equal) size 0 for motors 2 HP or less. Pump selector switch shall operate so that power to the non-operating motor starter is disconnected when its circuit breaker is tripped.
- (d) In addition to the foregoing, each pump shall be provided with protective and disconnecting devices, and wiring to comply with N.Y. City regulations and codes. Circuit breakers, motor starters, etc. shall comply with NEMA standards.



15B-7.18. Transfer Pump Set-(Cont.)

- (e) Gauges and relief valves shall be as specified in paragraphs 15B-7.05 and 15B-7.07. Gauges, etc. shall be oriented to the front (side away from wall) of pump set. See drawings.
- (f) Pump set shall be installed on a 4-inch high concrete base, furnished by this Contractor.
- (g)
  - 1. A galvanized or cadmium plated steel control cabinet not lighter than No. 14 gauge with hinged front door shall be mounted on the pump set. Hinges shall be heavy duty with removable pins. Switches shall be installed on the outside of the front face of the cabinet. Each item of control equipment shall be identified by engraved laminated plastic name plates. Cutouts shall be provided in the door to operate the circuit breakers and the motor starter resets. A wiring diagram of the pump and heater set shall be mounted on the interior surface of the cabinet door.
  - 2. The control cabinet shall contain the following equipment, all factory wired, as well as other necessary hardware and devices:
    - A. 3-pole circuit breaker for each oil pump motor
    - B. Magnetic starter for each pump motor
    - C. Pump selector switch (double-pole, double-throw)
    - D. Control circuit fuse block (single pole)
    - E. High limit oil pressure switch
    - F. 4-pole power supply terminal block
    - G. Required number of terminals to wire necessary external components.
  - 3. Exterior of cabinet shall be finished in gray enamel. Cabinet shall bear a building trades union label. Details of cabinet shall be shown on shop drawings submitted for the pump set.
- (h) Transfer pump set shall be of the highest grade manufactured by H. Liebllich & Co., Preferred Utilities Manufacturing Corp., Ray Burner Co., or other approved manufacturer complying with the requirements of the specifications and the drawings. Submit shop drawings for approval.

15B-7.19. Oil Storage Tanks

(a) General

Furnish and install cylindrical fuel oil storage tanks of dimensions shown on the drawings. Each tank shall be fabricated of Class "A" steel plates made by the open hearth or basic oxygen process. The plates shall be free from physical imperfections, such as laminations, cracks, mill scale, etc. Steel must be new, in good condition, and free from rust. Tanks shall be welded throughout, and shall conform with the requirements of the N.Y.C. Board of Standards and Appeals. Tanks shall be delivered to the site as soon as job conditions permit, in order to prevent delay in construction and in furnishing temporary heat. Submit shop drawings for approval.

(b) Welding

Welding for tanks shall be done by competent welders in a first-class manner. Lapped seams shall be not less than 2-inches and shall be continuously welded inside and outside. Nozzles for manholes and outlets for pipe connections shall also be continuously welded inside and outside.

(c) Openings

Provide openings shown on the drawings, located on top of shell of each tank. Size of opening for each pipe connection shall be the size of pipe connected, except as otherwise shown. Each manhole and suction bell opening shall have a 3/8-inch thick or heavier steel cover plate with two (2) 1/2-inch diameter steel lift handles welded to plate, and shall be provided with 1/8-inch thick oil resistant ring gasket, etc. Provide in manhole cover plate a 3-inch, half coupling with brass plug, welded to a 3-inch I.P.S. hole in plate. Cover plate and gasket shall be secured by (24) 5/8-inch diameter brass bolts and nuts. Couplings for pipe connections shall be continuously welded inside and outside of tank and plates. Tank openings shall be plugged until pipe connections are made.

(d) Ladder

From the manhole opening to the bottom of each tank, provide a ladder having 3/8 x 2 1/2-inch bar steel sides not less than 16-inches apart and 3/4-inch diameter steel rod rungs spaced on about 12-inch centers. Rungs shall go through the sides and be welded in place. Ladder shall be fastened to tank with angle clips, etc.

15B-7.19. Oil Storage Tanks-(Cont.)

(e) Painting

Storage tanks shall be thoroughly cleaned and painted on the outside at the factory with two coats of red oxide paint, and with one coat of black asphaltum paint. Red oxide coating shall be of different shades to facilitate inspection of the painting. All damaged spots shall be touched up. Refer to Section 15B-21.

(f) An affidavit in duplicate, stating that the thickness of steel, inside and outside welding, and painting of tanks fully comply with the specified requirements, shall be obtained from the manufacturer and delivered to the office of the Executive Director before tanks are shipped from factory.

(g) Identification

Each tank shall be provided with an approved type and size number plate, indicating the tank number, attached to tank at a location conveniently visible in the fuel oil tank chamber. Large size number welded on tank in lieu of the plate specified will be approved for this purpose. In addition, each tank shall bear a permanently fixed plate, spot welded or equivalent, bearing the name of tank manufacturer, gauge of material, and capacity of tank.

(h) Test

Each tank shall be hydrostatically tested at a pressure of 50 pounds per square inch for a period of at least 30-minutes without loss in pressure. Tests shall be made in the presence of authorized representatives of the Board of Education. In the event of leakage, tanks shall be made tight as approved and the test repeated.

(i) Furnish and install where directed two (2) charts for determining the amount of oil in tank when measured with a rod.

15B-7.20. Oil Fill and Vent Terminals

(a) General

Each fuel oil tank fill terminal shall be fitted with a watertight fill box, approved by the N.Y.C. Board of Standards and Appeals and bearing the approval calendar number. Each fuel oil tank vent terminal shall be fitted with a N.Y.C. Board of Standards and Appeals approved hood. Fill box and vent hood shall each be identified, by an approved permanent marking, with the tank number to which it is connected. Refer to Par. 15B-8.18 for piping.

15B-7.20. Oil Fill and Vent Terminals-(Cont.)

(b) Fill Boxes

Each fill box shall have a galvanized or cadmium plated cast iron body, cast bronze cap, gasket, and key. Fill boxes shall be Preferred Utilities Corp.'s Type W, or other approved.

(c) Vent Hood

Vent hood shall be of galvanized cast iron and shall have a free area of not less than the vent pipe area. Vent hood shall be Preferred Utilities Manufacturing Corp.'s "Standard Vent Protector" or other approved equal.

15B-7.21. Tank Level Gauges

(a) General

For each fuel oil storage tank, provide and install a liquid level gauge operating on the hydrostatic principle. Gauge shall be complete with hand pump and shall be either the column type or the dial type. Install annealed copper tubing, piping, fittings, etc. as required to complete the installation and to make it fully operative. The entire gauge installation shall be in accordance with the manufacturer's recommendations. Tubing between tank and gauge shall be enclosed in protective pipe or conduit. The oil gauge piping within the tank shall be enclosed in steel pipe, which shall be permanently braced to the bottom of the tank. The scale of each gauge shall be graduated in gallons, from the calibration chart furnished with the fuel oil tank. Each tank level gauge shall bear a name plate indicating the tank number with which the gauge is connected. Gauges shall be mounted on a finished hardwood or steel panel and secured to the wall or column in the location indicated on the drawings.

(b) Column Gauges

The frame of each column gauge shall be of non-ferrous metal. Capillary tube scale, with red indicating fluid, shall be of the length recommended by the manufacturer. Each gauge shall be complete with check valve, pump, balance chamber, etc. Gauges shall be Petrometer Corp. Model 1329, Uehling Instrument Co.'s Type S Tank-O-Meter, or other approved.

15B-7.21. Tank Level Gauges-(Cont.)

(c) Dial Gauges

Each dial gauge shall have a direct reading scale at least 10-inches in length, and shall have a bottom mounted hand pump. Gauges shall be the equal of Pneumercator Co. Model P-29 or Preferred Instruments Model TG-HP-10.

15B-7.22. Suction Bell and Stub Electric Heater

- (a) Install in each fuel oil storage tank a steel suction bell fabricated and piped in accordance with the detail shown on the drawing.
- (b) Provide and install in the suction stub, an electric immersion heater of the low density type, of wattage shown, thermostatically controlled and set at 100°-110°F. Thermostat head and electric connections shall be enclosed in a water-and-vapor-proof connection box. Shop drawings shall be submitted for approval. Stub electric heater shall be manufactured by General Fitting Co., Preferred Utilities Manufacturing Corp., or other approved equal.
- (c) Electric service wiring connections to the stub electric heater will be made by the Contractor for Electric Work.

15B-7.23. Boiler Room O.A.I. Damper Motors

- (a) As indicated on the drawings, the Boiler Room outside air intake opening shall be divided equally into the number of sections corresponding with the number of boilers. Each section shall be provided with parallel type multiblade dampers, automatically operated by the oil burner control for which it is intended. It shall cause the damper section to open fully whenever the forced draft fan is operating and to close when the fan is not operating. Motor shall be securely mounted on the damper frame and connected with linkage to the damper blades.
- (b) Damper motor shall be oil-immersed, spring return, capacitor type designed to operate with a transformer on single phase, 120-volt, 60 Hz service. Transformer shall have thermal overload protection. Each motor shall be equipped with an end switch which shall be so wired into the oil burner control circuit as to prevent the opening of the main full valve unless the outside air damper is open.
- (c) Damper motors shall be the equal of Honeywell's M 845. Electric wiring between each oil burner control cabinet and its corresponding outside air damper motor shall be furnished and installed by this Contractor. Refer to Para. 15B-19.10 for damper specification.

15B-7.24. Electric Work

(a) General

HVAC Contractor shall furnish and install all starters, wiring, connections, etc. (except as otherwise specified in sub-paragraph (b)) complete, leaving the entire oil burning system in satisfactory operating condition. Equipment shall be provided with terminal boxes to receive connecting conduits. All electric work shall conform to the requirements of the Bureau of Gas and Electricity, and other authorities having jurisdiction. Contractor shall file an application for electrical inspection with the Bureau of Gas and Electricity. At the completion of the electrical work, he shall submit with his application for progress payment, the pink copy of the job posting card issued by the Bureau of Gas and Electricity in connection with each application for certificate of electrical inspection.

(b) Work by Contractor for Electric Work

Contractor for Electric Work will furnish main electric service wiring to each control cabinet, to the pump and heater set (or to transfer pump set), to electric suction stub heaters and to remote control switch and emergency cut-out switches. Remote control switch and emergency cut-out switches will be furnished and installed by the Contractor for Electric Work.

(c) HVAC Contractor shall provide terminals on the equipment to receive the service wiring, together with motor starters, contactors, protective and disconnecting devices, etc., as required to make the installations complete. Wiring between the control cabinets and the burner equipment, burner controls, low water cut-offs, smoke indicator, induced and forced draft fans, draft sequence equipment, boiler lead-lag control, and outside air intake damper motors, shall be provided by this Contractor. Where motor starters are required, they shall be magnetic type as specified in Par. (f).

(d) Conduit

Wiring shall run in rigid conduit, excepting the wiring in control cabinets, and where flexible connections are necessary. Wiring connections between each control cabinet and the ignition assembly box shall be in either rigid conduit or in flexible oil tight conduit. Wiring connections between the ignition assembly box and the burner motor, and between the ignition assembly box and the oil heater at the burner shall be in flexible oil tight conduit with

15B-7.24. Electric Work-(Cont.)

twist receptacles, or other approved type receptacles. In other locations, flexible metal conduit (Greenfield) may be used for final connections not exceeding 3-feet in length. Rigid conduits shall be not less than 3/4-inch, standard weight galvanized steel conduit, large enough to accommodate the wires specified. Flexible oil tight conduit shall be U.L. approved. No conduit shall be installed in or on the boiler room floor.

(e) Conductors

1. Conductors shall be copper of 98% conductivity, and free of splints, flaws, or other defects. They shall be in accordance with the N.Y.C. Electric Code, and with Bulletin No. 8, 1963 of the Department of Water Supply, Gas and Electricity. Conductors shall be delivered in their original packages or reels, which shall be marked with the manufacturer's identification and date of manufacture. Conductors manufactured more than one year prior to delivery at the job will not be accepted.
2. Wiring between the oil burner control cabinet and associated equipment installed by this Contractor shall be type THW, 90°C. 600 Volt.

(f) Magnetic Motor Starters

Starters for control of the motors shall be magnetic type and shall be equipped with proper size thermal overload relays, and enclosed triple-pole (25-ampere contactor) magnetic switch providing overload and voltage failure protection. Magnetic motor starters for the oil burner motors shall be Allen-Bradley 709 (size 0 for motors up to and including 2 H.P.) or other equal of Cutler-Hammer or Square D. Where motor starters with disconnect switches are required, the starters may be combination type, the equal of Allen-Bradley 712 (size 0 for motors up to and including 2 H.P.). Where fuse protections are required, the starters shall be equipped with proper size fuses.

15B-7.25. Fire Extinguishers

Furnish and install in directed location at each burner, one 5-pound capacity ABC dry chemical charge fire extinguisher. Extinguisher shall be approved by N.Y.C. Board of Standards and Appeals and shall be so labelled.

SECTION 15B-8  
PIPE, FITTINGS, PIPING

15B-8.00. Pipe

(a) General

All pipe used shall be new, standard size, free from scale or rust. Each length of pipe shall be properly marked at the mill for proper identification with name or symbol of manufacturer. Dimensions for steel pipe shall be in accordance with the American National Standards Institute designation B36.20. Dimensions for red brass pipe shall be in accordance with ASTM designation B 251.

(b) Steel Pipe

Steel pipe shall be made from soft weldable quality steel, and shall conform to the requirements of the latest revised ASTM designation A 120. Steel pipe shall be as manufactured by Bethlehem Steel Co., Jones & Laughlin Steel Corp., National Tube Co., Republic Steel Co., South Chester Tube Co., Wheeling Steel Corp., or Youngstown Sheet & Tube Co.

(c) Galvanized Pipe

Galvanized pipe, when specified or shown on drawings, shall be galvanized with Prime Western Spelter by the hot process and not wiped.

(d) Brass Pipe

Brass pipe shall be semi-annealed seamless drawn and shall conform to the requirements of the latest A.S.T.M. Designation B43. Red brass pipe shall contain between 84 and 86 per cent copper. All brass pipe shall be of the highest grade manufactured by Anaconda American Brass Co., Chase Brass & Copper Co., Phelps Dodge Copper Products Corp., or Revere Copper & Brass, Inc.

(e) Copper Tubing

1. Copper tubing for refrigerant piping and for thermostatic air piping shall be hard drawn type "L" as defined by the Copper and Brass Association, and shall meet the requirements of ASTM Designation B-88. Refrigerant tubing shall be delivered to the site internally cleaned, packed with nitrogen or other inert gas, and capped.
2. Copper tubing shall be manufactured by Anaconda American Brass Co., Chase Brass & Copper Co., Phelps-Dodge Copper Products Corp., or Revere Copper and Brass Inc.



15B-8.00. Pipe-(Cont.)

(f) Pipe Duties

Pipe duties shall be as follows:

1. Extra strong (Schedule 80) black steel pipe:

Use for steam heating return mains, return riser runouts, steam heating coil returns, drips, blow-offs, boiler feed, boiler equalizer, and vent lines.

2. Extra strong (Schedule 80) galvanized steel pipe:

X  
Use for all piping buried in the ground, and for oil fill and oil vent lines. (Pipe buried in the ground or in floor fill shall be painted as specified in Par. 15B-21.09 (e).)

3. Standard weight red brass pipe:

Use for compressed air reducing station, water piping, piping between boiler and water column, between boiler and water feeder, between boiler and steam gauge, between boiler and secondary low water cut-off, and drip piping from water column, water feeder and secondary low water cut-off.

4. Copper tubing with copper or brass solder fittings:

Use for thermostatic air piping. Compression type fittings are not acceptable. Tubing shall be hard temper in straight lengths where exposed. Concealed tubing shall be hard or soft temper in coils or in straight lengths. The use of polyethylene plastic tubing for thermostatic air piping complying with the requirements of Par. 15B-8.20 is also acceptable.

5. Copper tubing with brazed fittings:

Use for refrigerant piping.

6. Standard weight (Schedule 40) galvanized steel pipe:

Use with galvanized cast iron fittings for condensate drain pan discharge piping, and for other drains from the hot and/or chilled water systems.

7. Standard weight (Schedule 40) black steel pipe:

Use for hot and/or chilled water piping, steam mains, steam and return risers, convactor return branches, and for all other purposes not specified herein.

15B-8.01. Fittings, Etc.

(a) General

Fittings for pipe lines shall conform to the following:

1. All fittings, except couplings and unions, in steel pipe lines shall be of threaded pattern, standard weight, black cast iron. They shall be suitable for a working steam pressure of 125 psi, except as otherwise specified below. Threaded fittings shall conform with Federal Specification WW-501a, Type A, Class I. The "Y" fitting in the vacuum pump discharge piping and all fittings in the fuel oil piping within the building may be of malleable iron.
2. Where the drawings show fittings to be flanged, or where piping connects to flanged equipment, etc., flanges shall be made of high grade cast iron or steel. Inlet piping connection to hot and/or chilled water pump shall include a flanged base elbow, the equal of Grinnell's Figure 805 or Stockham's figure 415. Fittings in welded piping shall be as specified in (c).
3. Fittings for copper tubing for refrigerant use shall be wrought copper with solder type ends and shall conform to ANSI Standard B-16.22. Forged brass fittings are also acceptable for this purpose. Fittings shall be suitable for working water pressure up to 250 psi. The use of cast brass fittings for this service will not be approved.
4. Fittings used in brass piping shall be malleable brass, threaded pattern.
5. Fittings used in automatic sprinkler piping shall be in accordance with the requirements of the N.Y.C. Building Code. Refer to Subparagraph (k) and to Par. 15B-8.19.
6. Fittings for oil fill, oil vent and for piping buried in the ground shall be standard weight galvanized cast iron. 5.
7. In the outlet from each cooling coil condensate drain pan, provide a tee with a brass plug in one end to facilitate cleaning of drain.

15B-8.01. Fittings, Etc.-(Cont.)

(b) Nipples

All nipples shall be of same material as the pipe used in the lines, excepting the nipples with less than 1-inch unthreaded length, which shall be made of extra strong pipe.

(c) Welding Fittings

Welded pipe lines shall have welding fittings. Branch connections from mains and headers shall have welding outlet fittings specially made to fit over the openings. Welding outlet fittings shall be "Weldolets" etc., manufactured by Bonney Forge and Tool Works, or other approved equal. Backing rings shall be inserted into the beveled pipe ends, the approved equal of Robvon Backing Ring Co.'s Type CCC. Welding ells shall have a mean radius approximately the outside diameter of the pipe. Welding fittings shall be of same material as the pipe or equivalent as approved and shall have wall thickness not less than the wall thickness of the pipe. The ends of pipe which are to be welded shall be machine chamfered. The ends of fittings which are to be welded shall be factory chamfered. The use of field chamfered fittings will not be accepted. The use of shaped nipples manufactured by Allied Piping Products, Babcock & Wilcox, Crane Co., Tube Turns, or other approved equal will be sanctioned. Welding rods shall be high test rods of material similar to the pipe, or equal as approved.

(d) Eccentric Fittings

Reductions in sizes of steam mains and hot and/or chilled water mains shall be made with eccentric fittings. To avoid trapping of condensate or air in mains at eccentric reducers, install steam piping eccentric reducers with the offset to the bottom of the run, and install water piping eccentric reducers with the offset to the top of the run.

(e) Reducing Fittings

Except for welded piping, no fittings shall be tapped for drip except in boss provided for that purpose. Reducing fittings shall be used where drips are required.

(f) Right-and-Left Couplings

Final connections in piping shall be made with right-and-left couplings or fittings, except as specified in Par. (g). Right-and-left couplings for steel pipe shall be of malleable iron. Right hand couplings for steel pipe may be of steel.

15B-8.01. Fittings, Etc.-(Cont.)

(g) Unions

In general, unions shall be used in piping only adjacent to units of equipment such as pumps, oil burners, compressors, heating coils, etc., or in other locations where specified, where shown on the drawings, or where written permission is granted prior to installation. Unions shall not be used in mains. Refer also to Par. 15B-8.13. Where unions are used, they shall be 300 lbs. Working Steam Pressure malleable iron with bronze-to-bronze, bronze-to-iron, or brass-to-iron ground joint, except as otherwise specified. The pressure rating shall be indicated on the union. Unions shall be the approved equal of E.M. Dart Co., S.G. Flagg Co., General Fittings Co., Grinnell Co., or Stockham Co. Unions in brass piping shall be 125 lbs. (minimum) W.S.P. all brass or all bronze with ground joint, the approved equal of S.G. Flagg Co., Grinnell Co., or N.Y. Brass Foundry.

(h) Flanges

Flanges shall be of the American Standard as adopted by the American Society of Mechanical Engineers. Welding flanges shall be socket type.

(i) Gaskets

Gaskets for steam service shall be of the type consisting of a spirally wound stainless steel V-shaped strip with non-asbestos filler and an outer steel compression ring. They shall be suitable for high pressure steam service and shall be the equal of Garlock Mechanical Packing Division. Non-asbestos gaskets for water service use may be of sheet packing material.

(j) Pipe Bends

Pipe bends shown on drawings shall be made up from one length of pipe, threaded at ends for coupling or chamfered for welding. Pipe bends shall be made on radii not smaller than shown on drawings and all expansion pipe bends shall be properly anchored.

(k) Mechanical Coupling Type Fittings

The use of mechanical coupling type fittings on sprinkler piping in lieu of threaded pattern fittings is acceptable in sizes 2-inches to 8-inches inclusive. The mechanical couplings shall be self-centering and shall engage and lock the grooved pipe and/or fittings in a positive couple while allowing for some degree of angular pipe deflection, contraction and expansion.

15B-8.01. Fittings, Etc.-(Cont.)

Each coupling shall consist of a malleable iron or ductile iron housing in two or more segments, a single molded composition sealing gasket, and two or more steel oval neck track bolts with hex nuts. Entire coupling installation including pipe grooving shall be performed in accordance with the manufacturer's instructions. Gustin-Bacon No. 105 Gruvagrip and Victaulic Style 75 couplings, together with their respective grooved end pipe fittings, or equal having N.Y.C. Board of Standards and Appeals approval for this purpose, will be accepted.

(1) Flexible Hose

Furnish and install flexible hose connections in each water line at the circulating pumps and at the chillers in the locations shown on the drawings. Hose shall be made of stainless steel with close pitch annular corrugations, and shall have metallic braid covering. It shall be Allied Metal Hose Co. Style SSC-1, Flexonics Series 400L-Type 321, Metraflex Co. Type SL, or approved equal. Submit shop drawings for approval.

15B-8.02. Pipe Hangers and Supports

(a) General

Horizontal overhead pipes shall be supported by approved pipe hangers, spaced approximately 10-feet apart. Hangers for copper tubing shall be spaced approximately 8-feet apart. In all cases, spacing of hangers shall be such as to prevent sagging or the forming of pockets in the piping. Hangers shall not pass through ducts. Pipe hangers shall be manufactured by Fee & Mason Mfg. Co., F. & S. Central Mfg. Co., Grabler Mfg. Co., Grinnell Co. or approved equal.

(b) Method of Attachment to Building Structure

1. Floor Slabs of Structural Reinforced Concrete:  
Piping shall be supported by hangers attached to beams, or to concrete inserts installed before the pouring of the floor slab. Refer to Par. 15B-8.05, regarding concrete inserts.
2. Floor Slabs of Composite Metal Decks:  
This type of construction consists of corrugated sheet steel and reinforced concrete, with steel beams. Overhead piping installed in areas having this type of construction shall be supported by hangers secured to beam clamps or to steel deck inserts. Steel deck inserts shall be as specified in Par. 15B-8.05.

15B-8.02. Pipe Hangers and Supports-(Cont.)

(c) Insulated Piping

Each pipe hanger supporting insulated piping shall be provided with a pipe covering protection shield. Shield shall be the equal of F.&S. Central Figure 980 or Grinnell Figure 167.

(d) Hangers for Pipes Smaller Than 5-inches

Each hanger for pipe sized smaller than 5 inches shall be forged or malleable iron ring type, or steel clevis type, supported by a solid steel rod. Refer to Standard Details.

Note: Rod size for sprinkler piping of 4 inch or 5 inch pipe size shall be 5/8 inch.

(e) Hangers for Pipes 5-inches and Larger

Each hanger for pipe sized 5-inches and larger shall be formed of a section of steel angle having a 3/4 inch diameter steel rod, threaded at both ends, run through a drilled hole near each end of the angle. Secure two nuts at the bottom end of the rod. Refer to Standard Details.

(f) Sockets

Sockets used on upper ends of rods at beam clamps and on lower ends of rods for single hangers shall be malleable or forged steel with standard machine threads. Refer to Standard Details.

(g) Pipe Supports

1. Mains located near floors shall be supported on roller type pipe stands, bedded in cement base. When mains are installed before concrete floor is laid, the mains shall be supported from overhead construction until the pipe stands can be put in place. Any work damaged in connection therewith shall be made good. Pipe roll stands shall be Fee & Mason Fig. 160, F & S Central Fig. 79, Grabler Fig. 40A or Grinnell Fig. 271.

2. Horizontal piping connections (near Floor) to convectors, unit ventilators, indirect heaters, etc. located more than 4-feet from risers shall be supported on adjustable iron pipe stands. Pipe stand shall consist of a split ring extension hanger mounted on a hanger flange, which shall be secured to the floor. Split ring hanger shall be the equal of F. & S. Central's Fig. 4 with Fig. 6 hanger flange.

15B-8.02. Pipe Hangers and Supports-(Cont.)

3. Piping in trenches shall be supported on special type hangers as shown on Standard Details.

(h) Painting

Pipe hangers, supports, stands, etc. shall be delivered to the site with one coat of red oxide or zinc chromate primer.

(i) Anchors

Where shown on the drawings, piping shall be anchored or braced to prevent vibration and excessive expansion at any one point. Anchors shall be in accordance with the Standard Details. Alternate methods of anchoring piping may be approved. Contractor shall submit detailed shop drawing of alternate method he proposes to use and obtain approval of same, prior to installation. Refer to Par. 15B-8.14 for riser clamps.

(j) Trench Covers

HVAC Contractor shall do necessary cutting and fitting of trench covers around pipes installed by him, whether covers are furnished by him or by other parties.

15B-8.03. Sleeves for Pipes

(a) General

All pipes, including thermostatic air piping, passing through floors, walls, partitions, furring, beams, trenches, etc. shall be provided with sleeves installed and maintained by this Contractor. Sleeves for floors, walls and other masonry work shall be set in place before the slabs or walls are constructed. Each sleeve shall be so located and maintained that the space around the installed pipe will be nearly equal. Each sleeve shall be of one piece construction. Pipe insulation shall not go through the sleeve, but shall be neatly finished at both ends of the sleeve.

NOTE: In buildings having floor slabs of composite metal deck construction, the HVAC Contractor shall be responsible for cutting holes in the steel deck for his piping. Holes larger than 6-inches in diameter will be reinforced by others. All sleeves shall be placed by this Contractor as specified in this paragraph.

15B-8.03. Sleeves for Pipes-(Cont.)

(b) Sheet Metal Sleeves

1. Sleeves for pipes passing through floors, partitions, hung or furred ceilings, shall be made of not lighter than No. 24-gauge galvanized sheet steel with 1/2-inch maximum clearance all around pipes. Each sleeve for a pipe passing through a floor slab shall be fitted with a one-inch flange, or equivalent, at the bottom end for the purpose of securing it to the form work. The sleeve shall be flush with the top of the finished floor. Sleeves for pipes passing through partitions, and hung or furred ceilings shall be flush with the finished surface.
2. The space between each installed pipe and its sleeve shall be completely packed with asbestos free mineral wool, or equivalent non-combustible material, and escutcheon plates, as specified in Par. 15B-8.04 shall be installed. This requirement applies to sleeves made of sheet steel or of pipe.

(c) Pipe Sleeves

1. Watertight pipe sleeves for HVAC piping through foundation walls will be furnished and installed by the Contractor for General Construction. Refer to the General Construction drawings. The opening between the sleeve and the installed pipe shall be caulked and made watertight by the HVAC Contractor. Polysulphide compound, lead, or other approved equivalent water-proofing material shall be used for this purpose.
2. Other pipe sleeves for HVAC piping through foundation walls shall be provided by this Contractor and will be set in the walls by the Contractor for General Construction. Pipe sleeves shall be standard weight steel pipe, approximately two sizes larger than the pipes passing through same. Sleeves shall be flush with inner and outer faces of wall. The Contractor for General Construction will make tight the opening between these sleeves and the installed pipes.
3. Sleeves for exposed pipes through shower room, toilet room and J.S.C. room floors shall be galvanized steel and shall have welded clips, or equivalent, at the bottom ends for the purpose of securing sleeves to form work or to metal deck. Sleeves shall be sized to provide 1/2-inch maximum clearance all around installed pipes. Sleeves shall be set water-tight and shall project approximately 1-inch above the finished floor so that



15B-8.03. Sleeves for Pipes-(Cont.)

the plate, specified in Par. 15B-8.04, will properly fit over the sleeve. Sleeves shall finish flush with the bottom of the slab. The space between the sleeve and the installed pipe shall be packed as specified in Par. 15B-8.03 (b) 2.

(d) Faulty Work

Where faulty installation of sleeves, etc. occurs, this Contractor shall make the necessary changes and shall repair floors, etc. to the satisfaction of the Executive Director, otherwise the Executive Director will direct the Contractor for General Construction to do this work, which shall be paid for by the HVAC Contractor.

(e) Unused Openings, Etc.

Where openings intended for use by this Contractor are left in floors or walls by Contractor for General Construction and are not used, such openings shall be filled in to match adjoining work by the HVAC Contractor. All additional openings required and not requested while the work proceeds shall be cut by the HVAC Contractor. See Par. 15B-1.35.

(f) Block Partitions

Sleeves for piping penetrating block partitions shall be set before the blocks are laid up, so as to avoid cutting of the blocks.

15B-8.04. Floor, Ceiling and Wall Escutcheon Plates

- (a) Piping passing through floors, walls, furring, partitions, hung ceilings, etc. throughout the building, whether exposed or concealed, shall be provided with an escutcheon plate to close the opening between the pipe and the sleeve. Plates shall be fastened in place before the pipes are covered or concealed.
- (b) Exposed floor plates in finished spaces shall be chrome plated cast iron, solid with set screw, the equal of F. & S. Central Mfg. Co., Fig. 601. In shower and toilet rooms, exposed floor plates shall be cast brass. Exposed ceiling and wall plates in finished spaces shall be chrome plated cast iron, solid with set screw, the equal of F. & S. Central Fig. 600.

15B-8.04. Floor, Ceiling and Wall Escutcheon Plates-(Cont.)

- (c) Concealed plates may be made of No. 18-gauge sheet brass or galvanized sheet steel, with set screws. This type of plate may also be used in locations where the use of the plates specified in (b) is not suitable for the closing of the space around the installed pipe.

15B-8.05. Inserts

- (a) Piping hung from slabs of poured concrete construction shall be supported from the slab by means of inserts furnished and installed by the HVAC Contractor. Inserts shall be installed in their proper locations before the pouring of the floor slabs. This Contractor shall cooperate with all other Contractors engaged in this project, in the installation of inserts in order to prevent any conflict as to their proper locations. Inserts shall not be painted.
- (b) Inserts for structural reinforced concrete floor slabs shall be the equal of Carpenter & Paterson Fig. 650. Inserts for pipe anchors shall be provided with bars as shown on the Standard Detail.
- (c) Inserts for composite metal decks shall be of a type that is supported entirely by the concrete slab, not by the metal deck. They shall be N.Y.C. Board of Standards and Appeals approved and shall be the equal of Phillips Drill Co.'s "Red Head" steel deck insert.

15B-8.06. Test Plugs

Provide and install capped nipple outlets in piping for cleaning and testing purposes, in the locations shown on the drawings.

15B-8.07. Piping

Contractor shall furnish, install, support and connect all piping, together with pipe, fittings, valves, etc., to complete the work as shown on drawings and as specified. Proper headroom shall be maintained below basement or ceiling piping, etc., and clearance shall be provided for work by other contractors, for the swing of doors, etc., as required. Allowance shall be made for expansion of piping as shown on drawings or where necessary, to prevent breakage or other damage. Piping shall be graded for drainage and shall be installed with cold strain. Offsets in piping shall be accomplished by means of standard fittings; pipe bends shall not be used for this purpose unless shown on the drawings or unless permission is obtained from the Executive Director to use pipe bends.

15B-8.08. Welding

- (a) Piping 2-inch and over may be welded (see Paragraph 15B-8.01(c) for welding fittings). Before assigning any welder to work covered by this specification, Contractor shall provide the Executive Director with the names of pipe welders to be employed in the work, together with certification that each of these welders has passed qualification tests prescribed by the National Certified Pipe Welding Bureau, or by other reputable testing laboratory, using procedures covered in the American Society of Mechanical Engineers Boiler Construction Code, Section IX, "Standard Qualification for Welding Procedure and Welding Operator", or in the American Welding Society "Standard Qualification Procedure".
- (b) The Executive Director shall have the privilege of ordering the drilling of one-half inch holes in joints or in pipes for inspection, up to a total number of cases not to exceed five per cent of the number of welded joints, provided the welds are found to have been properly made. If welds are found to have been improperly made or excess material has been extruded into the piping, additional drillings may be required from the Contractor and all or parts of the work may be rejected. Holes caused by drilling shall be closed by the Contractor as directed. Welded joints shall be properly built up so that there will be no thinning of metal at or adjacent to the joints.
- (c) High Pressure Steam Piping
  - 1. The Executive Director has the option of requiring the testing of welded joints in high pressure steam piping (a system operating at a steam pressure of more than 15 psi) to be performed in the manner specified in (b) or by means of radiographic inspection. If welds are found to have been improperly made, or excess material has been extruded into the piping, additional radiographic inspections may be required from the Contractor and all or parts of the work may be rejected. The testing laboratory selected by the Contractor to perform this work shall be acceptable to the Executive Director. The welding of high pressure piping shall be under Controlled Inspection, as required by the Building Code.

15B-8.08. Welding-(Cont.)

2. Applications for payments for the radiographic inspection shall be made on separate blanks without regard for any other work. Each application shall include the certificate of the testing laboratory for each day that the testing laboratory performed testing of welded joints. HVAC Contractor shall include in his bid an allowance for the payment of radiographic inspection costs, the amount of which will be stated in the Amendment, when applicable.

(d) High Pressure Water Piping

1. The Executive Director has the option of requiring the testing of welded joints in high pressure water piping (a system operating at a water pressure of more than 30 psi) to be performed in the manner specified in (b) or by means of radiographic inspection. If welds are found to have been improperly made, or excess material has been extruded into the piping, additional radiographic inspections may be required from the Contractor and all or parts of the work may be rejected. The testing laboratory selected by the Contractor to perform this work shall be acceptable to the Executive Director.
2. Applications for payments for the radiographic inspection shall be made on separate blanks without regard for any other work. Each application shall include the certificate of the testing laboratory for each day that the testing laboratory performed testing of welded joints. HVAC Contractor shall include in his bid an allowance for the payment of radiographic inspection costs, the amount of which will be stated in the Amendment, when applicable.

15B-8.09. Screw Joints

Pipe for screwed joints shall have smooth, clean and true to form, threads. Pipe shall not be bent, flattened or injured, either before or during installation. The ends of each piece of pipe shall be reamed after cutting to insure full cross sectional area. Screw joints for steam and condensate piping shall be made up to be perfectly tight without the use of lead or filler of any kind, except oil, graphite or approved brand pipe thread lubricating compound. Pipe sealing compounds similar to X-Pando or Permatex may be used only on oil or sprinkler piping.

15B-8.10. Brazed Joints

Joints in refrigerant piping shall be brazed. The outside of the copper tube and the inside of the fitting where solder will be applied, shall be cleaned and burnished with fine crocus cloth until all dirt and oxide is removed. A light coat of non-corrosive brazing flux shall be applied to both pipe and fittings. (Acid flux shall not be used.) Joint shall be uniformly heated to proper brazing temperature and the brazing material shall be fed to the joint until a uniform line of brazing material appears around the pipe at the end of the fitting. The brazing material shall be a hard solder such as silver solder or Sil-Fos.

Note: Brazing shall be done only by mechanics who are qualified for brazing refrigerant piping.

15B-8.11. Boiler Piping

- (a) Each boiler shall be connected with steam, feed water, city water, blow-off, water equalizing, trimming, etc. piping as shown on the drawings and as specified. Refer to the Standard Details. The steam header may be made with screwed fittings or it may be fabricated by welding at the shop with welding fittings specified in Par. 15B-8.01(c).
- (b) Contractor for Plumbing and Drainage will install a water supply line above the boilers and will leave an outlet near each boiler for the purpose of filling the boilers with City water. HVAC Contractor shall connect to these outlets and to the boilers as shown on the drawings.

15B-8.12. Mains

- (a) Steam Mains

Pitch horizontal steam piping in the direction of steam flow, excepting the runouts to risers and other piping which the drawings indicate is to be pitched against the flow. Minimum pitch shall be  $\frac{1}{4}$ -inch in 10-feet. Piping shall be hung at the elevations given on the drawing. Where the elevations are not indicated, install piping approximately 12-inches below the overhead beams, unless otherwise directed. In boiler, fan and equipment rooms, install piping so as to give easy access to valves.

- (b) Return Mains

Return mains shall be run in the locations shown on the drawings. Return mains, etc., on floors or in trenches shall not be installed until floors have been laid, unless otherwise directed. Such return piping shall be painted immediately after erection, as hereinafter specified. Return mains and branches

15B-8.12. Mains-(Cont.)

shall have a minimum pitch of at least  $\frac{1}{4}$ -inch in 10-feet in the direction of flow in pipes. Outlets of return piping in trenches, and at or near floor shall be plugged or capped until connecting piping has been installed.

(c) Low Points

Low points of each seal or pocket in piping shall be provided with a  $\frac{1}{2}$ -inch (minimum size) gate valve, arranged to empty the line completely.

(d) Water Piping

Mains for the hot and/or chilled water systems shall rise in the direction of flow, a minimum of  $\frac{1}{4}$ -inch in 10 feet. Piping shall be installed at the elevations indicated on the drawings and at the locations shown. It shall be so supported as to avoid the trapping of air. However, where trapping of air cannot be avoided, provision shall be made for manual venting of piping in such locations. Each low point in a main shall be provided with a 1-inch bronze hose gate valve, having a bronze cap and chain on the outlet. Valve shall be the equal of Crane Co.'s No. 451 of Jenkins No. 658.

(e) Condensate Drain Piping

Condensate drain piping from cooling coil drain pans shall be pitched at 1/16-inch per foot.

15B-8.13. Runouts

(a) Runouts from steam mains for risers, convectors, etc. shall be taken from top of steam main on a rise of 45° and shall be pitched toward the main, unless otherwise shown on the drawings.

(b) Runouts from return mains for risers, convectors, etc., shall be taken from the side of horizontal return main and shall be pitched toward the main, unless otherwise shown on the drawings.

(c) When final connections are to be made with risers, mains, etc., they shall be made with right-and-left couplings or fittings (unions not permitted) for sizes up to and including 2-inches. For sizes over 2 inches, connections shall be made with flanged unions. Couplings and unions are not required when mains and riser branches are installed before the risers, since final connections would not be needed. Refer to the Standard Details for sediment pockets for risers, and to the drawings for riser valves.

15B-8.14. Risers

Steam and return risers shall be installed in the locations indicated on the drawings. They shall be of the sizes marked on the Riser Schedule or Sheet. Where the distance between fittings is less than 18-feet, no couplings shall be used in the riser. Risers shall be supported and anchored at the first floor of a 3-story building, and at the second floor of a 4-story building. Riser supports shall be the equal of Fee and Mason Fig. 241 or F.&S. Fig. 91. Risers, connections to convectors, traps, etc., shall be neatly arranged and shall allow for expansion. Refer to Standard Details for sediment pockets and to Par. 15-8.13 for runouts.

15B-8.15. Drips, Test Connections

- (a) Drips shall be provided to keep horizontal steam piping free of condensation. They shall be connected from steam mains, branches, etc., at locations indicated on the drawings, through traps to return mains, per Standard Details. Each trap in a steam main drip shall have a strainer and a full size valved by-pass. Drips not shown on the drawings, but made necessary by job conditions, shall be provided as directed, as part of the contract.
- (b) Provide plugged tees for steam pressure and vacuum test connections in the locations indicated on the drawings. Test connections shall be as shown in details K and Ka on Standard Detail H 6.

15B-8.16. Vacuum Heating Pump Connections

- (a) Condensate return piping from direct radiation, heating coils, drips, etc., shall be connected into a vacuum heating pump suction header, unless otherwise shown on the drawings. Suction header shall be constructed of pipe, flanges, welding fittings, etc., in accordance with the Standard Details. A connection from the suction header to the vacuum pump receiving tank shall be provided as shown on the drawings.
- (b) Each discharge from vacuum heating pumps shall be connected to the boiler feed pump condensate receiving tank.
- (c) Vacuum pump installation shall be complete in all respects. Piping, valves, connections, etc., shall be arranged so that the pumping units will perform the specified duties when operating simultaneously or separately. Refer to "Guarantees" (Par. 15B-1.14) and to "Tests" (Par. 15B-1.40).

15B-8.17. Convactor, Unit Ventilator, etc., Connections

Furnish and install piping connections to convectors, steam unit ventilators, etc., indicated on the drawings. Each branch shall be pitched to its riser, or where applicable, to its main. Since each approved valve and trap for this use is equipped with a union end, no other union or coupling in the piping connection will be accepted, unless shown on the drawings. The use of right and left threaded fittings, where such use is necessary, will be approved. Each runout from a steam main to a convactor shall be provided with a gate valve near the steam main.

15B-8.18. Piping for Oil Burning Equipment

(a) General

Piping materials for the oil burner installation shall be as specified in Par. 15B-8.00 and 15B-8.01. Pipe lines shall be pitched in the direction indicated on the drawings, at least 1-inch in 10-feet, unless otherwise shown.

(b) Fill Pipe

Furnish and install a fill pipe, of size shown on drawings, for each tank. Fill pipes shall pitch toward tanks, shall be connected into tapping on tanks, and shall be extended as shown on the drawings to fill pipe terminals near the sidewalk curb. See Par. 15B-7.20 for fill box.

(c) Vent Pipe

A vent pipe of size indicated on the drawings shall be connected to the vent pipe tapping on each tank. It shall be extended to the location shown on the drawings, to a vent head as specified in Par. 15B-7.20. Vent pipe shall pitch toward tank and shall be supported, as indicated on the drawings.

(d) Suction Lines

Suction lines shall be connected to the tappings provided on top of the tanks and extended into the tanks as shown on the drawings. Overhead lines shall be pitched toward the tanks. In lieu of elbows, use tees with brass plugs (for cleaning purposes) in suction lines.

(e) Pump Connections

Provide suction piping connections to the pump and heater set, as indicated on the drawings. Include an O.S. &Y. valve in each suction line in the location shown. Refer also to Par. 15B-7.17.



15B-8.18. Piping for Oil Burning Equipment-(Cont.)

(f) Gas Piping

Contractor for Plumbing and Drainage will provide a gas supply service connection for burner ignition to each oil burner.

15B-8.19. Piping for Sprinkler Work

(a) Furnish and install all piping required for a complete sprinkler system as indicated on the drawings. Piping shall be installed in accordance with the requirements of the N.Y.C. Building Code.

(b) Sprinkler piping buried underground shall be extra strong (Schedule 80) galvanized steel pipe with extra heavy galvanized cast iron fittings. Vertical pipe through sidewalk for siamese connection shall be made of standard weight 85% brass pipe. Excavation and backfill for buried piping shall be provided by the HVAC Contractor. Buried piping shall be supported on firm ground to prevent damage to piping from settling. Piers shall be provided where required. Piping shall be so installed that it can be thoroughly drained.

(c) Provide a full-face 1/16-inch thick gasket in the flanged connection between the steel sprinkler piping and the brass piping outlet provided by the Contractor for Plumbing and Drainage. Gasket shall be made of reinforced rubber diaphragm sheet or other non-asbestos material suitable for this use.

15B-8.20. Air Piping for Temperature Control

(a) General

Furnish and install all air piping required for the temperature control systems specified. Piping shall be concealed wherever practicable, and shall be supported and anchored to prevent vibration and damage. No air lines shall be hidden within insulation. Exposed air piping passing through floors, walls, etc. shall have neatly fitted cast aluminum or cast brass escutcheon plates. Refer to Par. 15B-8.00 for piping materials, and to Par. 15B-8.02 for spacing of hangers. Sizes given in the following paragraphs are for copper tubing, and are the minimum sizes acceptable. It shall be the responsibility of the temperature control manufacturer to size all piping (above the minimum sizes specified) to insure proper operation of the entire temperature control installation. The number of mains and risers installed shall be determined by the temperature control

15B-8.20. Air Piping for Temperature Control-(Cont.)

manufacturer and shall be governed by the configuration of the building. It is the intent of this specification to provide a temperature control system that divides the building into several areas of control which may be conveniently isolated for future maintenance and repair. All joints in copper tubing shall be made with solder type fittings. The use of compression type fittings for this purpose will not be accepted.

(b) Air Distributing Header

Provide an air distributing header in the vicinity of the pressure reducing station specified in Par. 15B-19.06. Header and piping of pressure reducing station shall be made of brass pipe nipples with brass fittings. The use of type K copper tubing with brass or copper solder joint fittings is also acceptable for this purpose. Outlets of header shall be connected with the air mains, each of which shall be provided with a valve (or plug cock) at this location.

(c) Air Mains

Install air mains near the ceiling of the basement (or cellar, pipe and duct space, etc.). Mains shall be  $\frac{1}{2}$ -inch minimum size. Each main shall be provided with a drain cock at its low point.

(d) Air Risers

Air risers shall be run in concealed locations, but not near heating risers. Risers installed within plaster finish shall be completely embedded in the brown plaster coat. Each riser shall drain to the main, and shall be provided with a valve and with a pressure gauge close to the main. Risers shall be  $\frac{3}{8}$ -inch minimum size, except that a riser serving a fan or equipment room shall be  $\frac{1}{2}$ -inch minimum size. At least one riser shall be provided to serve each floor area. (e.g. A three story area shall have at least three risers.) See Par. 15B-8.03 for pipe sleeves.

(e) Thermostat Mains

At least one thermostat main shall be provided for each floor in an area, and it shall be run in a concealed location near the ceiling. Thermostat mains shall be  $\frac{3}{8}$ -inch minimum size.

15B-8.20. Air Piping for Temperature Control-(Cont.)

(f) Air Branches

Branches to thermostat terminal head connections, pneumatic valves, and air motors shall be  $\frac{1}{4}$ -inch size. Branches shall be secured to (but not within) the partition block, and shall be completely embedded in the brown plaster coat. Each air line connection to a pneumatic valve or air motor shall be made with a brass union, for easy disconnection and repair. Right and left couplings will not be permitted for this purpose.

Note: Air piping (copper tubing) installed in finished spaces on partitions which do not have a plaster finish shall be enclosed in Wire-mold, or equal, conduit. (For the purpose of this paragraph, "Finished Spaces" shall be understood to mean those spaces which have tile or "Special Coating" finished walls. Refer to the Architectural Drawings.)

(g) Air Outlet for Custodian's Work Area

A  $\frac{1}{4}$ -inch size compressed air outlet with cock shall be installed in the Custodian's Work Shop area at the work bench.

(h) Valve Tags

Each valve and plug cock shall be provided with a valve tag, as specified in Par. 15B-9.08.

(i) Plastic Tubing

1. The use of plastic tubing will be acceptable in the following areas: fan rooms, equipment rooms, cellar (or basement) pipe and duct spaces, cellar (or basement) custodial or storage areas and corridors or passages adjacent thereto, and within temperature control cabinets. It may also be used in other areas, provided that the plastic tubing is enclosed in  $\frac{1}{2}$ -inch minimum size galvanized or black Schedule 40 steel pipe (thin wall conduit not acceptable) which has been embedded in the floor slab, and provided that each thermostat and operator is connected with copper tubing at least 5-feet in length. In addition, the use of jacketed bundled plastic tubing will be accepted where installed within a hung ceiling provided that all of the following conditions are met:

15B-8.20. Air Piping for Temperature Control-(Cont.)

- A. A metallic junction box is provided at each point of a 90° change in direction of the tube bundle.
  - B. Branches from bundled tubing are started from metallic junction boxes.
  - C. An access door is furnished and installed in the hung ceiling at the location of each junction box and also at not greater than 50-foot intervals.
  - D. Tubing is supported on 3-foot maximum centers, as specified in sub-paragraph 7.
2. Plastic tubing shall not be installed in the following areas: boiler room; within an enclosure containing a heating element; adjacent to hot pipes, lights, or other heat source having a surface temperature in excess of 125°F; embedded in plaster or other masonry surface; in any location not specified in sub-paragraph 1.

Note: The use of plastic tubing within any part of a unit ventilator or a fan coil unit is not acceptable.

3. Plastic tubing shall be virgin black polyethylene, ASTM Type I, Grade 5, Class C. which withstands ASTM Stress Crack Test D1693-602T. It shall have a minimum wall thickness of 0.040-inch, and shall be flame retardant. The jacket of bundled tubing shall be of the same material as the enclosed tubing. Tubes in bundles shall be number coded. Plastic tubing shall be Dekoron FR as manufactured by Samuel Moore & Co., or other tubing meeting the requirements of this specification. Tubes and bundle jacket shall be marked with the maker's brand and type. Sizes of plastic tubing shall be the same as those specified for copper tubing.
4. Fittings used with plastic tubing shall be of brass or copper of the compression or barb push-on type, and shall be specifically designed for this application.
5. Plastic tubing installed in fan rooms and equipment rooms shall conform to the following: Single tubes shall be installed in thin wall conduit. Two or more plastic tubes shall be run in completely enclosed metallic raceway. Runs to terminal equipment (valves, motors, thermostats, etc.) shall be terminated in metallic junction boxes, and each run from junction box to terminal equipment shall be copper tubing of 5-foot minimum length.

15B-8.20. Air Piping for Temperature Control-(Cont.)

6. Plastic tubing mains installed in cellar (or basement) pipe and duct spaces, in pipe tunnels and in cellar (or basement) custodial or storage areas and corridors adjacent thereto shall be run in completely enclosed metallic trough or wire-mold raceway. Plastic tubing branches shall be run in thin wall conduit.
7. Jacketed bundled tubing installed within hung ceilings, as specified in sub-paragraph 1, shall contain at least one spare tube for each two (or fraction thereof) tubes in use, and shall be supported from the overhead slab or from structural members of the building by means of approved straps, cleats, or hangers spaced on 3-foot maximum centers. The use of wire or tape for this purpose is not acceptable. Branches from bundled tubing shall be made from a metallic junction box, and shall be run in thin wall conduit.
8. Metallic raceway shall be supported from the overhead slab, etc. by means of zinc plated steel angle hangers spaced on 4-foot maximum centers.
9. Submit sample of metallic trough and wire-mold raceway for approval, if not already approved.

(j) Drawings

1. Shop Drawings

Temperature control manufacturer shall include with the shop drawings specified in Par. 15B-17.00 (b), an isometric drawing of the entire air piping system.

2. "As Installed" Drawings

Provide and mount on a wall near the pressure reducing station, an "as installed" drawing of the entire temperature control piping system indicating the location and tag number of the isolating valves, and a schematic or isometric drawing of the system as installed. Each of these drawings shall be plastic laminated to a rigid panel of masonite or equal.

15B-8.21. Piping for Water Heaters

Where the Plumbing and Drainage Contractor furnishes a steam tube type water heater, the HVAC Contractor shall provide and install steam and return piping, temperature regulating valve, hand valves, traps, etc. as shown on the drawings and as specified.

SECTION 15B-9  
VALVES

15B-9.00. General for All Valves

(a) Description

Furnish and install all the valves shown on the drawings, specified herein and/or necessary for the control and easy maintenance of all piping and equipment. Valves shall be first quality of approved manufacture, shall have proper clearance, followers in the packing glands, and shall be tight at the specified test pressure. Each valve shall have the maker's name or brand, the figure or list number and the guaranteed working pressure cast on the body and cast or stamped on the bonnet, or shall be provided with other means of easy identification. Except otherwise specified or shown on the drawings, all valves shall have screwed ends and those 8-inches and larger may be flanged. Sprinkler valves 2½-inch and over shall be flanged. Valves which are concealed in hung ceilings, or in furring, etc., shall be made accessible by means of access doors, which this Contractor shall furnish and deliver to the Contractor for General Construction for installation. The access doors shall be constructed as specified in Paragraph 15B-17.09. All valves of one type throughout the job, shall be of the same manufacture.

(b) Working Pressure

Valves shall be designed for steam working pressure of not less than 125-pounds per square inch.

(c) Materials

Valves 2-inches and smaller shall be all brass or bronze. Valves 2½-inches and larger shall be iron body, brass or bronze mounted. Brass or bronze alloy for valves shall be in accordance with the latest A.S.T.M. Designation for the type of valves used.

(d) Wheels, Etc.

Shut-off valves shall have self-cooling type metal hand wheels excepting where specified otherwise herein. For valves other than outside screw and yoke type gate valves, the valve stem shall be extended through the wheel and provided with hexagon nuts to secure the wheel in place.

(e) Chain and Sprockets

Where the drawings indicate valves to be chain operated, they shall be provided with operating chains, sprockets and guides, equal to those supplied by

15B-9.00. General for All Valves-(Cont.)

Crane Co., Fairbanks Co., Jenkins Bros., or other approved make. Chains shall hang within 5'-6" of the floor. Provision shall be made for fastening the chains out of the way.

15B-9.01. Gate Valves

(a) All shut-off valves shall be gate valves, unless otherwise shown on the drawings or specified.

(b) Outside Screw and Yoke Type

Gate valves in lines leading from the boilers to the boiler steam header, in boiler blow-off lines, and at other points so specified or shown on the drawings shall have outside screw and yoke with bronze rising stem. Sprinkler system gate valves shall be as specified in this paragraph and shall be as approved by the public authorities having jurisdiction.

(c) Non-Rising Stem Type

Other iron body gate valves, including valves in connections to indirect radiation, shall have non-rising bronze stems.

(d) Rising Stem Type

Other brass or bronze gate valves furnished shall have rising stems, unless otherwise approved.

(e) Approved Types

Gate valves shall be of one of the following makes and types, or other approved equal. Catalog figure numbers are listed below.

Manufacturer	GATE VALVES			
	Iron Body Non Rising Stem	Bronze Rising Stem (Screwed Bonnet)	Iron Body Outside Screw & Yoke	Bronze
Chapman Valve Mfg. Co.	570,571	-	572,573	-
Crane Co.	460,461	428	464½, 46 5½	459
Fairbanks Co.	0402,0403	0252	0404,0405	0222
Hammond Valve Corp.	IR1137, IR1138	1B640	IR1139, IR1140	1B681
Jenkins Bros.	325,326	47	650-A, 651-A	275-U
Kennedy Valve Mfg. Co.	057,058	425	0601,0611	66
Lunkenheimer Co.	1427,1428	2127	1429,1430	831
Nibco-Scott Valve Mfg. Co.	T-619,F-619	T-111	T-617-0,F-617-0	T104-0
Stockham	G-608,G612	B-107	G-620,G623	B133
Walworth Mfg. Co.	719,719F	55	726,726F	873

15B-9.02. Globe Valves

Excepting the valves in pneumatic temperature control piping and pneumatic valves, no globe valve of size larger than ½-inch shall be used, unless otherwise specified or shown on the drawings. Where globe valves are approved, they shall be of the grade called for other valves.

15B-9.03. Check Valves

(a) General

Check valves shall be of heavy pattern, straightway, horizontal swing, re-grinding type with hinged check, ground seat and approved type bronze discs. The discs for check valves, of size larger than 2-inch may be bronze faced. Sprinkler check valves shall be as approved by public authorities having jurisdiction.

(b) Approved Types

Check valves shall be of one of the following makes and types, or other approved equal. Catalog figure numbers are listed below.

CHECK VALVES

Manufacturer	TYPES	
	Iron Body	Bronze
Chapman Valve Mfg. Co.....	69	-
Crane Co.....	372	34
Fairbanks Co.....	0701	0600
Hammond Valve Corp.....	-	1B940
Jenkins Bros.....	623	92-A
Kennedy Valve Mfg. Co.....	105	440
Lunkenheimer Co.....	1789	2144
Nibco-Scott Valve Mfg. Co.....	T-918-B	T-413-Y
Stockham .....	G-927	B-319
Walworth Mfg. Co.....	928	406

15B-9.04. Blow-Off Valves

Blow-off valve from each boiler shall be O.S. & Y. gate valve specified in Paragraph 15B-9.01(b).

15B-9.05. Other Cocks

Cocks, where specified or shown on the drawings in other lines, shall be for not less than 150 lbs. per square inch working pressure. Asbestos packed cocks will not be approved. Plug cocks shall be the equal of Lunkenheimer No. 454 or Walworth No. 554.



15B-9.06. Hose Gate Valves

Hose gate valves shall be provided for draining the piping at the low points of the system. Hose gate valves shall be 125 pounds per square inch, 3/4-inch, standard weight, bronze, with cap, the equal of Kennedy Fig. 29.

15B-9.07. Riser Valves

Furnish and install riser valves where shown on the drawings. Refer to Standard Detail for location of riser valves in the riser runouts. These valves shall be bronze rising stem.

15B-9.08. Valve Tags

(a) Each manually operated valve on any pipe line throughout the building which is furnished and installed as part of the HVAC work, except those valves at convectors, drips, indirect heater returns, water columns and water feeders, shall be provided with an identification tag. Tags shall be made of heavy brass or aluminum, or of white core plastic laminate. They shall be approximately 2-inches square, with rounded corners, and shall be attached to their respective valves by means of brass split key rings, brass hooks or by other approved method. The numbers shall be of block type, 1/2-inch high, engraved on plastic laminate tags and stamped on metal tags. The numbers on metal tags shall be filled with black enamel.

(b) The numbering of valves shall be arranged in the following manner:

- In Basement, Cellar, or Pipe Space below
- First Floor - No. 1 to No. 999
- In First Story - No. 1000 to No. 1999.
- In Second Story - No. 2000 to No. 2999.
- In Third Story - No. 3000 to No. 3999.
- In Fourth Story - No. 4000 to No. 4999.
- On Roof or in Roof Penthouse or Bulkhead
- No. R1 to No. R999.

In no case shall a number applying to one story, be assigned to a valve located in another story.

15B-9.09. Valve Charts

(a) This Contractor shall prepare a chart with the valve identification number of each valve shown thereon. Opposite each valve number shall be printed the location of the valve bearing that number and its use or the apparatus or piping it controls. This chart shall be submitted to the Executive Director for approval before prints are made therefrom.

15B-9.09. Valve Charts-(Cont.)

- (b) After the chart has been approved, one (1) print shall be made therefrom which shall be framed under single or double thick glass and permanently secured to wall with screws or bolts where directed in the Boiler Room. The frames shall be made of 1-inch wide oak picture moulding with wood back, and shall be finished with natural color varnish.
- (c) A typewritten copy of the valve chart shall be included in the Custodian's "Manual of Operating Instructions", specified in Par. 15B-1.45(b).
- (d) Refer also to Paragraph 15B-7.00(g).

SECTION 15B-10  
STEAM AND VACUUM SPECIALTIES

15B-10.00. Thermostatic Vacuum Traps

(a) Where Used

A thermostatic trap shall be provided in the condensate return connection from each convector, steam coil unit ventilator, cabinet heater or other heat source as indicated on the drawings or in the specifications.

(b) Type and Capacity

1. Thermostatic traps shall be designed to operate at any pressure between 10-inches (mercury gauge) vacuum and 15-pounds per square inch steam pressure (gauge), permitting air and water to escape and preventing the passage of steam to the return lines, or from the return lines to convector, etc.
2. Thermostatic traps shall be of volatile liquid expansion, multiple bellows or corrugated disc type, having the expansion member well above the trap inlet, but always exposed to the conditions of temperature and pressure in the heating source controlled thereby. The expansion member shall be in contact with the cover of the trap and held firmly in a fixed position so as to be positive in action and function without noise. A valve piece shall close against seat. Seats shall be renewable. Thermostatic traps shall be non-adjustable, without by-pass, and shall have been made up at the factory for the working conditions.
3. The capacity of each trap shall be ample for the duty which it is required to perform and shall be as approved by the Executive Director.

(c) Materials

Thermostatic traps shall have bodies and caps of bronze or best steam metal. Seats and valve pins shall be made of stainless steel and/or monel. The multiple bellows or corrugated disc shall be made of copper alloy or other corrosion resistant metal of sufficient thickness and construction to prevent collapse. The maker's name or trade mark shall be cast in the cap and the designation number cast in the body of the traps for identification purposes.

15B-10.00. Thermostatic Vacuum Traps-(Cont.)

(d) Connections, Tappings, Etc.

Trap sizes shall be as indicated on drawings. Reduction in sizes from connecting pipes to traps shall be made with reducing elbows or couplings. No pockets or seals shall be formed in connections to traps. Each thermostatic trap shall be equipped with ground joint type union inlet.

(e) Approved Makes

Thermostatic traps shall be one of the approved makes listed below, or equal conforming to the requirements of the specifications. Traps shall be of the same make throughout the building. In a building addition or modernization, traps may be of a different make than those originally installed.

<u>Manufacturer</u>	<u>Model</u>
Barnes & Jones, Inc.	Type E
Dunham-Bush, Inc.	No. 1E, 2E, 3C
Hoffman Specialty	No. 17C, 8C
Sarco Co.	Type TS-25

(f) Samples

If the Contractor proposes to install a trap of a make not specified in (e), he shall submit complete shop drawings and a cut-away sample of the trap for approval, prior to installation.

15B-10.01. Float-Thermostatic Traps (Combination)

(a) Where used

A float-thermostatic trap shall be provided on each steam main drip, main riser drip, on each air heating coil drip, reheater drip, and unit heater return connection, on the return connections from the heating element of each water storage heater and hot water converter, and elsewhere as shown on the drawings, or where the maximum condensate load to be handled exceeds fifty (50) pounds per hour. The thermostatic trap specified in Par. 15B-10.00 shall not be used in such return or drip connection.

(b) Type and Capacity

1. Float-thermostatic traps shall be designed to operate at any pressure between 10-inches (mercury gauge) vacuum and 15-pounds per square inch steam pressure (gauge), permitting air and water to escape and preventing the passage of steam to the return lines, or from the return lines to the equipment or piping being dripped.

15B-10.01. Float-Thermostatic Traps (Combination)-(Cont.)

2. Float-thermostatic traps shall consist of a ball-float trap provided with an automatic, bellows thermostatically controlled air by-pass. Each trap shall have a large size tapping with screwed plug at the lowest point of trap body for drainage and test purposes. The body shall be so designed that there is ample clearance under the float to prevent foreign matter from holding the trap open. The traps shall be so designed that the operating parts can be readily removed without removing the trap body from the piping. The maker's name or trade mark and designation number shall be cast in the body of the trap for identification purposes.
3. The capacity of each trap shall be ample for the duty which it is required to perform. Traps or drips shall have inlet and outlet of the same size as shown for the drip piping on the drawings. Ratings of float-thermostatic traps shall be in accordance with the latest standards adopted by the Steam Heating Equipment Manufacturers Association.

(c) Connections

See Standard Details for connections.

(d) Approved Makes

Float-thermostatic traps shall be one of the approved makes listed below. Traps of other makes, equal in all respects to those listed, will be considered for approval, providing that data of certified tests of performance and capacity as well as of tests of the thermostatic element and float under operating conditions, all made by a recognized university or testing laboratory approved by the Executive Director, are submitted. Traps shall be of the same make throughout the building. In a building addition or modernization, traps may be of a different make than those originally installed.

<u>Manufacturer</u>	<u>Model</u>
Barnes & Jones, Inc.	Type T
Dunham-Bush, Inc.	No. 40, No. 30
Hoffman Specialty	Series 50
Sarco Co.	Type FT

15B-10.02. Self Powered Temperature Regulators

- (a) Furnish and install a self powered temperature regulator to control the steam flow to the coil of each water heater provided by the Plumbing and Drainage Contractor. Temperature regulator shall consist of a valve with a thermostat and capillary tubing. Tubing shall be enclosed in flexible armor for its entire length. Valve shall have double seats of stainless steel. It shall be adjustable for temperatures between approximately 110° to 160°F., with an initial setting of 140°F.
- (b) Regulating valve shall be of size shown on the drawings and shall be installed in the location indicated, with the bulb inserted in the heater tank. The excess flexible tubing shall be neatly coiled and secured so as to prevent damage to it. A Y-type strainer shall be installed in the steam line before the regulating valve.
- (c) Valve shall have iron or semi-steel body with stainless steel trim. Temperature regulator shall be one of the following makes.

<u>Manufacturer</u>	<u>Model</u>
Lawler Automatic Controls	Type 5
Robertshaw-Fulton	No. 1003-D1
MCC-Powers	No. 11
Sarco Co.	No. 50-21A

15B-10.03. Strainers

- (a) Provide and install where specified or where shown on the drawings, a strainer having a cast iron or semi-steel body and a removable screen of brass, monel or stainless steel. Strainers in pipes 2-inches and smaller shall be Y-type. Those in larger size pipe may be Y-type or basket type, with bolted cover and cleanout plug in bottom, and with closed bottom basket type screens. Strainers shall be designed for 125 psi (minimum) steam working pressure. They shall have screwed or flanged ends.
- (b) Strainers shall be one of the makes listed below. Refer to Par. 15B-7.04 for strainers in the oil burner system.

15B-10.03. Strainers-(Cont.)

<u>Manufacturer</u>	<u>Type</u>	<u>Model</u>
Dunham-Bush, Inc.	Y	Type SSA or F211 A
Hoffman Specialty	Y	Series 400
McAleer	Y	Style SG
McAleer	Basket	No. 528-B
O.C. Keckley	Y	Style B
O.C. Keckley	Basket	Style D
Mueller Steam Specialty	Y	No. 11
Mueller Steam Specialty	Basket	No. 145, No. 165
Sarco Co.	Y	Type AT
Sarco Co.	Basket	Type 528B

15B-10.03. Thermostatic Steam Valves.

- (a) Provide and install a thermostatic valve in the steam connection to each convector, installed under this contract, where the drawings do not indicate that the convector is under pneumatic valve control. Thermostatic valve shall be of a self-powered type in which the room temperature sensing element is contained either in a remote bulb or in a thermostatic head located on the valve body.
- (b) The temperature sensing remote bulb shall be mounted on the back wall of the convector enclosure, opposite the air inlet grille. Where the convector enclosure is of the expanded metal type, the thermostatic head type valve shall be used and the head shall extend outside the enclosure.
- (c) Thermostatic steam valves shall be manufactured by Braukman Controls Corp., Danfoss Inc., Flair Manufacturing Corp., Ammark or Honeywell. Submit shop drawings for approval.

SECTION 15B-11  
HOT AND/OR CHILLED WATER SPECIALTIES

15B-11.00. Hand Valves for Convectors

- (a) Provide and install a hand valve in the water supply connection to each hot water convector not controlled with a pneumatic valve. Valve shall be of the spring packed type, of pattern to suit condition of installation. It shall be of the quick-opening type, of cast brass or bronze, designed for at least 125 psig water pressure. Valve body shall have rough finish, with the design working pressure cast or stamped on it. Valve shall be equipped with a ground joint type union outlet.
- (b) Convector valves shall be one of those listed below. If the Contractor proposes to install a hand valve not specified, he shall submit complete shop drawings and a cut-away sample of the valve for approval prior to installation.

<u>Manufacturer</u>	<u>Model</u>
Barnes & Jones, Inc.	Series 88
Dunham-Bush, Inc.	No. 740A
Hoffman Specialty	No. 184
Sarco Co.	Type RP

15B-11.01. Strainers

Furnish and install a Y-type strainer in each location shown on the drawings of the hot and/or chilled water system. Strainer shall be designed for water service and shall be as specified in Par. 15B-10.03.

15B-11.02. Balancing Valves

Where the drawings indicate a balancing valve in the water piping, provide and install a 150 psig diaphragm packless type combination shut-off and balancing valve, with the diaphragm attached to the valve stem. Valve shall be complete with a locking mechanism that can be set at a balance point, so that the valve may be opened and closed, but not opened beyond the pre-set balance point. Valve shall be furnished with an indicator, marked to show 0% to 100% of flow. Valve body shall be of cast iron or semi-steel, and shall be painted with a rust-preventive epoxy or equal coating. Balancing valves shall be American Air Filter's Illinois Series 4000 for sizes up to 1½-inch, Sarco's "Balance Master" for sizes up to 2-inches, or other approved equal. Larger sizes shall be American Air Filter's "Illinois Series 5000", or approved equal. Submit shop drawings for approval.



15B-11.03. Air Vents

Provide and install a manual air vent in the hot and/or chilled water piping system in the locations indicated on the drawings. Air vent shall consist of a ¼-inch bronze pet cock with lever handle, fitted into a pipe tee. Pet cock shall be similar to Crane Co.'s No. 702 or Lunkenheimer Fig. 980.

15B-11.04. Pressure Gauges

Provide and install a vacuum gauge and a pressure gauge at each water circulating pump in the location indicated on the drawings. Each gauge shall be 4½-inch diameter. Vacuum gauge shall be graduated from 0 to 30-inches of mercury. Pressure gauge shall be graduated from 0 to 50-pounds per square inch. Gauge shall have an aluminum case, phosphor bronze or beryllium copper bordon tube, and brass socket. Gauge dial shall have black numerals on a white background and shall indicate the pressure range within an accuracy of 1/2 of 1% of scale range. Gauge shall be as manufactured by Acme Gauge & Instrument Co., Ashcroft Gauge of Dresser Industries, J.E. Lonergan Co., H.O. Trerice Co. No. 600 Q, U.S. Gauge Co., Weksler Instrument Corp., or other approved equal. Submit shop drawings for approval.

15B-11.05. Thermometers

Provide and install in the locations indicated on the drawings of the water systems, 9-inch long mercury column type thermometers. Each thermometer shall be the adjustable angle type with a one piece case and sealed replaceable glass element, and with a brass separable socket. Face plate shall have black numerals on a white background and shall indicate the temperature range of 30° to 240°F. Thermometers installed in insulated piping shall have 2-1/2 inch long extension necks. Thermometers shall be manufactured by Marshalltown Mfg. Inc., Moeller Instrument Co., H.O. Trerice Co., Weiss Instrument Co., Weksler Instrument Co., or other approved equal. Submit shop drawings for approval.

15B-11.06. Relief Valves

Provide and install in the water systems in the location shown on the drawings an ASME approved safety relief valve. Valve shall have iron body and non-ferrous internal parts. Valve shall be gradually relieving type, not "pop" type. Valve shall be Bell & Gossett Co.'s No. 175, or other approved equal. Submit shop drawings for approval. Valve setting shall be as indicated on the drawing.

15B-11.07. Reducing Valve

Where shown on the drawing, provide and install in the make-up water supply line, an iron body pressure reducing valve with brass internal parts. Reducing valve shall be provided with a strainer and a check valve to prevent back flow of water when city water pressure is less than the system pressure. Valve shall be Bell & Gossett Co.'s No. 12, or other approved equal. Submit shop drawings for approval. Valve setting shall be as indicated on the drawing.

15B-11.08. Air Separating Tank

Furnish and install in the location shown on the drawing a welded steel air separating tank of size indicated. Tank shall be provided with inlet and outlet connections, connection to compression tank, and a drain connection. Tank shall be constructed according to ASME code stamped with the "U" symbol and supplied with form U-1 certifying National Board compliance. The air separating tank shall be installed in accordance with the manufacturer's instructions and shall be furnished with a performance guarantee. Tank shall be the equal of Bell & Gossett Co.'s In-Line Air Separator No. IAF. Submit shop drawings for approval.

15B-11.09. Compression Tank

Provide and install in the location indicated on the drawings, a welded steel compression tank, of indicated capacity. Tank shall be constructed for 125 psig working pressure according to ASME code, stamped with "U" symbol and furnished with Form U-1 denoting compliance with paragraph U-69 of the ASME code for construction of unfired pressure vessels. Tank shall be guaranteed leak-proof by the manufacturer and shall be rust-proof coated on its exterior surface. Provide a drain tapping at bottom of tank and install a hose bibb valve in this opening. Compression tank shall be Bell & Gossett Co.'s or other approved equal. Submit shop drawings for approval.

15B-11.10. Compression Tank Fitting

Furnish and install on the inlet to the compression tank, a tank fitting for the proper control of air in the tank. Tank fitting shall be iron body with non-ferrous internal parts, constructed for 125 psig working pressure and shall have a separate manual copper vent tube for establishing the proper air volume in the compression tank on initial filling. The tank fitting shall be installed in accordance with the manufacturer's instructions. Tank fitting shall be the equal of Bell & Gossett Co.'s No. ATF. Submit shop drawings for approval.

15B-11.11. Compression Tank Drain Fitting

Provide and install in a tapping on the compression tank a drain valve with hose threaded outlet and with means to introduce air to the tank to facilitate drainage. Drain valve shall be the equal of Bell & Gossett Co.'s No. DT-2 "Drain-O-Tank Air Charger".

15B-11.12. Water Circulating Pumps

- (a) Provide and install in the locations indicated on the drawings, centrifugal type pumps for circulating water through the hot and/or chilled water systems. Pumps shall have the capacity, head and horsepower characteristics listed in the engineering data on the drawings. Pumps and motor shall be specially designed for quiet operation. Each pump shall be base mounted on a 4-inch high concrete base and shall be of horizontal or vertical split case design. Pumps shall be installed, aligned and started in accordance with the manufacturer's recommendations.
- (b) Pump volute shall be of cast iron, supported by the pump base and shall have a venting petcock at its high point, Impeller shall be bronze, mounted on a heat treated carbon steel shaft. Bearing shall be oil lubricated sleeve type, and an oil level indicator shall be provided. Pumps shall be equipped with watertight mechanical seals; packing gland pumps will not be accepted. Tapped gauge openings shall be provided in the suction and discharge flanges.
- (c) Pump motors shall comply with the requirements of Section 15B-16. Motor shall be flexibly connected to the pump. It shall be equipped with either sleeve or ball bearings. Each pump motor shall be provided with a black, beveled, laminated plastic name plate 1/8-inch thick. Nameplate shall have 3/8-inch high white core letters indicating the pump service and number, e.g. "Cooling Circulating Pump No. 1", "Standby Circulating Pump".
- (d) Pumps and motors shall be tested for operating characteristics and the report of these tests, curves and complete shop drawings shall be submitted for approval. Pump data shall include make and model number, design and actual gpm, bhp, maximum shut off and design head, rpm, suction and discharge pressure. Motor data shall include make and model number, hp, rpm, NEMA Code letter, full load current and voltage.
- (e) Circulating pumps shall be Armstrong Pumps, Inc. Series 4023 Type "MSH", Bell & Gossett Co. Series 1510 Universal pump, Dunham-Bush Inc. Type B-9, Taco Inc. "SB" Series, or equal complying in all respects with the requirements of the drawings and the specifications.

15B-11.13. Flow Switches

Furnish and install a flow switch in each location shown on the drawings of the chilled water system. Switch shall be wired by the HVAC Contractor into the control circuit of each refrigeration compressor so that power to the compressor will be interrupted in the event of loss of flow in the chilled water system. Flow switches shall be provided and installed in other locations of the water systems where indicated on the drawings and shall be wired as directed. Flow switches shall be the approved equal of McDonnell & Miller Inc. No. FS4-3.

15B-11.14. Water Flow Rate Control

- (a) Furnish and install a means of water flow rate control at each location so indicated in the hot and/or chilled water piping drawings.
- (b) For pipe size up to and including 3-inches, provide a valve having an integral pointer to indicate degree of valve opening and having tapings for connecting a portable differential meter. A calibrated chart shall be furnished, to be used for determining the flow rate. Valve shall be the equal of Bell & Gossett's "Circuit Setter" Model CB.
- (c) For pipe sizes over 3-inches, provide a nickel plated orifice insert having tapings for connecting a portable differential meter. Insert shall be calibrated, and furnished with a nameplate showing capacity curve. Insert shall be installed with gaskets between standard ASA pipe flanges. A globe valve furnished with square operating nut, shall be provided and installed in the piping on the discharge side of the insert at a minimum distance of 12-inches. Orifice insert shall be the equal of Bell & Gossett's "Circuit Sensor" Model OP.
- (d) HVAC Contractor shall provide one differential pressure meter, the equal of Bell & Gossett's Model RO-2, complete with mounting board, hoses, valves, fittings, etc. The meter may be used by the Contractor in balancing the system and shall be delivered in good working condition to the Custodian at the completion of the work. A receipt for the meter, signed by the Custodian, shall be delivered to the Executive Director.
- (e) Each device used in the water flow rate control shall be installed in accordance with the manufacturer's instructions. Submit shop drawings of each such device for approval.

15B-11.14. Water Flow Rate Control-(Cont.)

Note: The water flow rates indicated on the drawings are based on the use of heating/cooling equipment of the capacity indicated in the tables on the drawings. It shall be the responsibility of the Contractor to compute the water flow rates required for the equipment actually installed and to set each water flow rate control accordingly. These rates shall be indicated on a flow diagram, which shall be submitted for approval.

15B-11.15. Differential Pressure Regulating Valve

When shown on the drawings, provide and install a pressure differential regulating valve in the circulating water by-pass piping, in the location indicated. Valve shall be normally closed, single seated, pneumatically operated. It shall have a bronze body with stainless steel disc and seat, and shall be suitable for the operating pressure and temperature of the system. Valve shall be Honeywell Type KP514C, or equal of Johnson Controls, MCC Powers or Robertshaw Controls.

15B-11.16. Hot Water Converters

- (a) Provide and install hot water converters of the shell and tube type designed so that the water flows through the tubes and the steam condenses in the shell. Each converter shall be of the size and capacity indicated on the drawings.
- (b) Converter shall have flanged steel shell and cast iron head, bossed and tapped for piping connections. Tube bundle shall be of the removable type consisting of not less than 3/4-inch O.D. No. 18 BWG seamless copper tubes bent to U-shape with both ends of the tube expanded into the steel tube sheet. Tube supports within the shell shall be of brass or steel. Shell shall be equipped with mounting legs. Outlets for steam and condensate connections shall be provided in the shell.
- (c) Manufacturer's data report for unfired pressure vessels, form No. I-1 as required by the provisions of the ASME Code Rules, shall be furnished. This form shall be signed by a qualified inspector, holding a National Board commission, certifying that construction conforms to the latest ASME Code for unfired pressure vessel. Converters shall be Bell & Gossett Co.'s Type SU converter, or other approved equal. Submit shop drawings for approval.
- (d) Temperature control of the hot water converters shall be as specified in Par. 15B-19.23.

SECTION 15B-12  
CONVECTORS AND ENCLOSURES

15B-12.00. General

- (a) Furnish and install convectors and enclosures in the locations indicated on the drawings. Enclosures for fin-tube convectors shall, in general, be constructed as shown on the Standard Details. Enclosures for non-ferrous finned multi-tube convectors shall be of best commercial quality and shall be constructed as specified herein. Exposed screw heads for all convector enclosures shall be "Phillips" cross-recessed type, unless otherwise specified.
- (b) Exposed surfaces of convector enclosures shall be fabricated from stretcher leveled furniture steel. The use of stretcher leveled steel sheets having a zinc-iron alloy coating of 0.3 ounces per square foot (minimum) by the A.S.T.M. Triple Spot Test is also acceptable. Coating shall provide a surface which is free of spangles and which can be finish painted without being prime coated. Coating shall be Bethlehem Steel Co.'s "Bethcon Jettcoat," Jones & Laughlin's "Jett-Wipe," National Steel's "Weir-kote Type JP," or U.S. Steel's "Redi-Kote." Contractor shall take measurements at the site before fabricating the enclosures, which shall be installed without damaging other work. Enclosures shall be made ready for installation immediately after plastering is completed.

15B-12.01. Convector Protection

Convectors shall be shipped from the factory in suitable protective covering. They shall be installed in time for temporary heat use, and provision shall be made to prevent their being clogged with plaster, etc. Effective protection (e.g. plywood perforated for air circulation or expanded metal) shall be installed at the top and front of each convector element from the time of installation until the permanent enclosures are in place so as to prevent damage to fins, tubing, etc., during the period of building construction. Convector element openings shall be closed with suitable plugs or caps at the plant to prevent the entrance of dirt, sand, etc., and to protect the threads.

15B-12.02. Shop Drawings and Schedules

Detailed shop drawings and schedules of all types of convectors and enclosures shall be submitted to the Executive Director for his approval before this equipment is shipped from the factory.

15B-12.03. Painting

- (a) The inside and outside surfaces of each enclosure shall be primed at the factory with a sprayed coat of zinc chromate paint. Enclosures fabricated from zinc alloy coated steel sheets (as specified in Par. 15B-12.00(b)) shall be prime painted only if the mill coating has been damaged.
- (b) Finish painting of enclosures will be done by the Contractor for General Construction after installation of the enclosures. Interior surfaces of enclosures visible from the outside shall be painted by the HVAC Contractor with one coat of flat black paint.

15B-12.04. Fin-Tube Convectors and Enclosures

(a) General

Furnish and install fin-tube convectors, complete with steel enclosures, pipe support brackets, vertical support brackets, etc., as shown on the drawings and as specified. Fin-tube convectors shall have steel or non-ferrous heating elements as indicated on the drawings. Refer to Standard Details.

(b) Heating Elements

1. Steel

Elements for fin-tube steel convectors shall be constructed of steel tubes and steel fins with the tubes drawn through the fins and expanded, thus forming tight metal to metal contact. Fins shall be properly spaced prior to expanding the tubes. Except otherwise shown on the drawings, there shall be 40 fins per linear foot with fins  $4\frac{1}{2}$  x  $4\frac{1}{2}$ -inch in size and .032-inch thick. The tubes shall be  $1\frac{1}{2}$ -inch size seamless or electric resistance welded pressure tubing (ASTM A-214) with wall thickness not less than 0.125-inch. Elements shall be single width and 1, 2 or 3 rows high as shown on the drawings. Each row shall be welded together with welding return bends (6-inches center to center), thus forming a continuous welded unit with only the inlet and outlet connections threaded. Each unit shall be tested at not less than eighty (80) pounds per square inch hydrostatic pressure and made tight at that pressure.

2. Non-Ferrous

Elements for non-ferrous convectors shall be constructed of aluminum fins and copper tubes and they shall be fabricated and tested in a manner similar to the steel elements specified above, except that return bends shall be solder type copper (6-inches center to center). There shall be 40 fins per linear foot with fins  $4\frac{1}{4}$  x  $4\frac{1}{4}$ -inch size, .020-inch thick aluminum. Fins shall be permanently bonded to the tube by having a mandrel drawn through the tube, thereby uniformly expanding the tube against the fins. Alloy and minimum temper for aluminum fins shall be 3003-H18. Tubes shall be  $1\frac{1}{4}$ -inch nominal size,  $1\frac{3}{8}$ -inch O.D. type K copper.

3. Ratings, Etc., for Fin-Tube Radiation

Sizes of tubes and fins, thickness of fins, spacing of fins and lengths of finned tubes shall be as shown on the drawings. Fin-Tube convector ratings shall be approved under the latest edition of the IBR Ratings for Finned Tube (Commercial) Radiation. In addition to the above approval, the ratings shall be not less than those tabulated on the drawings for the types of construction and various rows, heights, etc.

(c) Supports for Fin-Tube Convectors

Fin-tube convector elements shall be supported in accordance with drawings. Approved alternate design of support brackets may be substituted provided they are adjustable both horizontally and vertically.

(d) Enclosures for Fin-Tube Convectors

1. Fin-Tube convector enclosures in rooms of instruction shall fill the entire space between the piers adjoining the windows, unless otherwise indicated. Where an enclosure does not terminate at a pier or a wall, the enclosure shall be extended to cover the end of the convector, including the piping connections, and an end enclosure or cap of the same gauge as the front shall be installed. Enclosures shall be constructed of cold rolled sheet steel, and shall be of gauges, etc., as shown on the drawings. Steel members of the enclosure which contact aluminum window parts shall be coated with zinc chromate primer before installation. Grilles may be of stamped steel. Panel fasteners shall be Dzus or Camloc type, with slotted heads.



15B-12.04. Fin-Tube Convectors and Enclosures-(Cont.)

The ½-inch thick insulation behind the convector elements shall be 3-pound density rigid fiber glass board. The shield protecting the insulation shall be No. 20-gauge galvanized sheet steel. Commercial design enclosures may be substituted in lieu of the Standard Detail design, provided prior approval is obtained.

2. Where expanded metal enclosures are indicated on the drawings, the enclosures shall be fabricated of ½-inch diamond mesh, No. 16-gauge expanded steel, flattened. A ½-inch wide steel band shall be spot welded to each end of the enclosure. Enclosure shall cover the convector at top, bottom and front and shall be fastened to the wall with expansion bolts and shields.

(e) Approval

In order to receive approval for Fin-Tube convectors and enclosures, Contractor shall submit complete shop drawings showing details of construction, and the ratings for the convector elements. He shall submit a sample of the convector element if it has not already been approved.

15B-12.05. Fin-Tube Convectors for Kindergarten Rooms

(a) General

Furnish and install non-ferrous fin-tube convectors, complete with support brackets, insulation, etc., as shown on the drawings and as specified for the Kindergarten Rooms.

(b) Heating Elements

Heating elements shall be as specified in Par. 15B-12.04(b) and shall be of the sizes indicated on the drawings. They shall be supported from the enclosure in accordance with the details shown on the drawings. Attention is called to Par. 15B-15.10.

(c) Insulation

The exterior wall behind the heating element shall be covered with ½-inch thick asphalt impregnated fiber-board insulation equal to Federal Specifications LLL-F-321(b) Class-C as indicated on the drawing. The lower section of insulation shall be impaled over pins which have been secured to the wall with a cold setting adhesive. The upper portion of the insulation shall be covered with No. 20-gauge sheet steel and shall be secured to the wall with tempered steel nails.

Non-Ferrous Finned Multi-Tube Convectors and Enclosures  
(Commercial Type)

(a) General

Furnish and install convectors of types, sizes, ratings, etc., shown on the drawings and herein specified. Each convector shall be complete with a heating element, cabinet, etc., and shall be rated in accordance with commercial standard CS 140-47 developed by the trade, and the National Bureau of Standards, U.S. Dept. of Commerce. The ratings of convectors shall have been approved by the Convector Rating Committee as provided for in CS 140-47. Variations in design sizes (length or height), providing that the rating is not diminished, may be accepted subject to approval.

(b) Heating Elements

Heating elements shall be fabricated with heavy wall seamless copper or 85% red brass tubes, aluminum fins and cast iron or cast bronze headers. Fins shall have integral flanged collars which shall act as spacers. Tubes shall be mechanically expanded into the fin collars for permanent metal-to-metal contact with the collars. Tubes shall be securely joined to supply and return headers by means of tapered brass bushing rolled into the tube-to-header joint or they may be brazed with 1000<sup>o</sup>F. silver solder. Fins shall be protected with galvanized steel or aluminum side plates which are flanged over the fins continuously or which have stiffeners not more than 15-inches apart. Elements shall be tested at not less than 150 psig under water and made tight before shipment from the factory. Each element shall be provided with means of support at both headers, and with means of pitching the element for steam or water circulation and for the elimination of air. Where intermediate elements occur, they shall be joined with brass couplings.

(c) Enclosures

1. General

Heating elements shall be contained in steel cabinets of types, etc., shown on the drawings and specified. Each cabinet front panel shall be constructed of a single piece of cold rolled sheet steel. Cabinets shall have top outlet grilles and bottom inlet openings, or bottom inlet grilles as shown. Grilles shall be an integral part of front panels, unless otherwise

Non-Ferrous Finned Multi-Tube Convectors and Enclosures  
(Commercial Type)-(Cont.)

indicated. Integral grilles shall have deflecting vanes which shall direct the warmed air into the room space. Fronts and tops of enclosures shall be No. 14-gauge and the backs and sides No. 18-gauge or heavier cold rolled steel. Enclosures over 48-inches in length shall have a horizontal channel stiffener spot-welded to the inside of the enclosure front, midway between the grilles. Where filler pieces or end pockets are called for, they shall be of same gauges as the cabinets. Cabinets shall be of same manufacture as the elements, unless otherwise indicated. Each recessed or semi-recessed convector enclosure installed on an exterior wall shall have insulation secured to the outside of the back of the enclosure. Insulation shall be 1/2-inch thick, 3-pound density rigid fiber glass board.

## 2. Recessed Cabinets with Exposed Front Panels

Convectors shown on drawings recessed with exposed front panels, shall have their cabinets installed in recessed openings provided by the Contractor for General Construction. They shall each be provided with a one piece removable front panel overlapping the opening to conceal the edges of the opening. Positive seal shall be provided by means of a sponge rubber gasket to prevent air leakage around the opening. Panel shall have top and bottom integral grilles, and the edges of the panel shall be rounded to eliminate sharp protrusions. A hinged access door shall be provided in the bottom (inlet) grille at the location of the steam valve. The inside surface of the front panel shall be covered with a 1/16-inch (min.) thick coating of sound deadening material, the equal of Korfund Dryamics Corp. "Vibrodamper Compound". This type of cabinet is indicated on the drawing as "RC".

Note: This Contractor shall furnish a steel frame, of proper size, similar in construction to the "Type A" frame shown on the Standard Detail, for each "RC" convector. He shall deliver the frame to the Contractor for General Construction, who will install it, in ample time to prevent delay in the construction of partitions, furring, etc. Frame shall be given a shop coat of red oxide or zinc chromate paint. Where required, cut-outs shall be made in the bottom of the frame to allow for piping connections. The "RC" enclosures shall be secured to this frame.

15B-12.06. Non-Ferrous Finned Multi-Tube Convectors and Enclosures  
(Commercial Type)-(Cont.)

3. Recessed Cabinets with Exposed Grilles Only

These shall be of such design that the cabinets will be completely concealed in building construction and the inlet and outlet grilles will be flush with the finished wall. Elements for these units shall be removable from the top outlet. Grilles for these convectors shall be bar type anodized aluminum, not less than No. 12-gauge, unless otherwise shown.

4. Sloping Top Cabinets

A. The convector enclosures indicated on the drawings as "SW" shall be wall hung, with integral outlet grille in the sloping top and with bottom inlet opening. Variations in design sizes (length or heights), provided that the rating is not diminished, may be accepted, subject to approval.

B. Wall mounted commercial type convectors shall be securely supported from wall by means of expansion bolts and shields on 18-inch maximum centers, one row near the top and one row near the bottom of the enclosure. Submit details of mounting for approval.

5. Wall-to-Wall Enclosures

A. Where the drawings indicate non-ferrous finned multi-tube, convector elements in a wall-to-wall enclosure, the enclosure shall be constructed in accordance with the details shown on the drawings and as specified herein. This Contractor shall take all necessary measurements at the site before fabricating the enclosures and they shall be installed without damaging other work. Enclosures shall be made ready for installation immediately after plastering is completed.

B. Each enclosure shall be constructed of cold rolled sheet steel with outlet grille in the sloping top and with bottom inlet opening. Grille shall be an integral part of the front panel. Front of enclosure shall be divided into removable panels as shown in the details on the drawings. Each panel shall be constructed of one sheet of No. 16-gauge sheet steel; back shall also be No. 16-gauge steel. The ½-inch insulation behind the back shall be as specified in Par. 15B-12.04(d). Each enclosure shall be secured to the building wall as shown on the drawing.

15B-12.06. Non-Ferrous Finned Multi-Tube Convectors and Enclosures  
(Commercial Type)-(Cont.)

6. Fasteners

Fasteners for convector fronts, access doors, etc., shall be approved type Allen head, wrench operated camlocks. Sheet metal screws will not be accepted as fasteners on removable panels.

7. Access Door

A hinged access, approximately 8" x 6" in size, shall be furnished in the enclosure front to provide access to the supply valve.

(d) Approved Makes

Convectors manufactured by Airtherm Manufacturing Co., Dunham-Bush/Webster, Governale Bros. Inc., Trane Co. or Universal Convector Corp. conforming with the requirements of the drawings, specifications and job conditions will be approved.

SECTION 15B-13  
VACUUM HEATING PUMPS

15B-13.00. Vacuum Heating Pumps

- (a) Furnish and install vacuum heating pumping apparatus of the duplex assembled type as shown on the drawings and as specified.
- (b) Each duplex pumping unit shall be complete with two (2) water pumps, and two (2) air exhausters. The combination of one water pump and one air exhauster may be driven by one motor, or each may be driven by a separate motor. Each pump unit shall include a heavy, close-grained cast iron or copper-bearing steel receiving tank which shall be float controlled and which shall contain air separator, suction strainer, relief valve, pressure gauge, vacuum gauge, 3/4-inch water level gauge with suitable guard and brass try-cock, 5-inch thermometer, and control cabinet. Where a copper-bearing steel tank is furnished, it shall be fabricated of steel plate not less than 1/4-inch thick, having a copper content of 0.25% (minimum), and it shall have a corrosion resisting lining of a material acceptable to the Executive Director. Independent suction and discharge connections with companion flanges shall be provided.
- (c) Each pump shall be of the impeller type, fitted with bronze internal parts, equipped with ball bearings and stainless steel or bronze shaft, driven by a ball bearing motor of the horse power and speed indicated on the drawings. Motors shall be drip proof. Size of motors shown on the drawings shall be the maximum allowed.
- (d) Controls
  1. Provide a combination across-the-line type motor starter for each motor consisting of a three-pole main contactor, equipped with thermal overload relays in each phase leg and a three-pole fused motor circuit switch mounted within the control cabinet and having an externally operable handle. (The switch handles shall be mechanically interlocked with the door, so that the door cannot be opened unless the switch is in the "OFF" position.) Also provide seamless reinforced copper float operated switches for the water pumps, and two (2) vacuum regulators. Each duplex unit shall be equipped with two (2) three-position selector switches. Positions

15B-13.00. Vacuum Heating Pumps-(Cont.)

shall be designated with suitable name plates as follows:

Position No. 1: FLOAT & VAC. ON

Position No. 2: FLOAT ON - VAC. OFF

Position No. 3: CONTINUOUS

2. Provide manual sequence control (Lead-Lag) for each duplex unit. A selector switch (in addition to the two selector switches specified in Par. (d)(1) shall be provided and shall have a nameplate reading: "VACUUM PUMP No. 1 LEADS - VACUUM PUMP No. 2 LEADS". This control shall provide for (1) manual selection of the active pump, (2) automatic simultaneous operation of both pumps under abnormal load conditions, and (3) automatic operation of the inactive pump or lag pump if the lead pump or its control fails.
3. Starters for motors up to and including 3 horsepower shall be Size 1, Type 1, and for motors above 3 HP shall be Size 2, Type 1. They shall be Allen-Bradley 712, Cutler-Hammer 9589, General Electric Co. CR 7008, or Square D 8538.
4. Float switches shall be General Electric Co. CR 2931, Square D Class 9036 or 9037, or other make equal in all respects and approved by the Executive Director.
5. Vacuum regulators shall be set for 2-inches minimum and 7-inches maximum vacuum. They shall be Cutler-Hammer Bulletin 10014, General Electric Co. CR 2922, Mercoid Corp. Type DA 31-3 Range No. 2 (0-30-inches vacuum), Square D Class 9016 BSG-1, or other approved equal.
6. The combination starters shall be mounted within the control cabinet, with the selector switches mounted in the cover of the cabinet. The control cabinet shall be mounted on the pump set and completely wired at the factory, including wiring between controls and motors, complete and in accordance with N.Y. City Electrical Code requirements. All leads shall be brought to numbered terminal strips to which all external connections shall be made. Power supply connections to the terminal strip will be made by the Contractor for Electric Work. A complete wiring diagram shall be mounted inside the cabinet door.

15B-13.00. Vacuum Heating Pumps-(Cont.)

(e) Each pump shall have not less than the capacity of equivalent direct radiation indicated on the drawings. The combination of one (1) water pump and one (1) air exhauster shall have not less than the simultaneous capacities for water in gallons per minute and air in cubic feet per minute specified on the drawings. With all pumps operating, indicated air and water quantities shall be doubled. Quantities of water and air specified are at a temperature of 160<sup>o</sup> F. from 5½-inches vacuum, and water quantity given is against discharge pressure indicated.

(f) Tests

1. Vacuum pumps shall be tested by the manufacturer at his factory in accordance with the latest ASHRAE "Standard Code for Testing and Rating Return Line Vacuum Heating Pumps."
2. Contractor shall submit in duplicate for approval certified air and water capacities based upon tests of the pumps made by the manufacturer as specified above, so that the capacity of each pump can be verified after installation of the equipment at the site by similar tests which shall be made by this Contractor under the direction of the manufacturer of the pumps when directed by and in the presence of a representative of the Executive Director. This Contractor shall provide and connect all equipment necessary for the proper conducting of this test.
3. Refer also to Paragraph 15B-1.39 of this specification regarding pump tests to be made during the five (5) day test of the entire installation.

(g) Shop Drawings

1. Contractor shall submit to the Executive Director for approval, before manufacture, complete shop drawings of all pumping equipment, special piping, motors, motor starters, auxiliary controls, wiring diagrams, etc.
2. The capacity curves specified in Paragraph (f) 2 shall be submitted before complete acceptance of the pump.



15B-13.00. Vacuum Heating Pumps-(Cont.)

(h) Protection

Pumps shall be given one coat of rust inhibitive paint at the factory, and shall be finish painted as specified in Paragraph 15B-21.07. Pumps shall be protected by tarpaulins or other protective material and shall be kept clean and dry until they are ready for operation.

(i) Approved Makes

Vacuum heating pumps manufactured by Domestic Pump, Dunham-Bush, Inc., ITT Hoffman Specialty, Sarco Co., Inc., or Skidmore Pumps, conforming to the requirements of the drawings, specifications, and job conditions will be approved.

SECTION 15B-14  
BOILER FEED PUMPS

15B-14.00. Boiler Feed Pumps

- (a) Provide and install in the location indicated on the drawings, two (2) single stage centrifugal type boiler feed pumps. Pumps shall have the capacity, head and horsepower characteristics listed in the engineering data on the drawings. Pump and motor shall be specially designed for quiet operation. Each pump shall be base mounted on a 4-inch high concrete base and shall be of horizontal or vertical split case design. Operating parts shall be accessible without disturbing piping or motor connections. Pumps shall be installed, aligned and started in accordance with the manufacturer's recommendations.
- (b) Pump volute shall be of cast iron, supported by the pump base and shall have a venting petcock at its high point. Impeller shall be bronze, mounted on a heat treated carbon steel shaft. Bearings shall be oil lubricated sleeve type, and an oil level indicator shall be provided. Pumps shall be equipped with water tight mechanical seals; packing gland pumps will not be accepted. Tapped gauge openings shall be provided in the suction and discharge flanges.
- (c) Pump motors shall comply with the requirements of Section 15B-16. Motor shall be flexibly connected to the pump. It shall be equipped with either sleeve or ball bearings. Each pump motor shall be provided with a black, beveled, laminated plastic name plate 1/8-inch thick. Nameplate shall have 3/8-inch high white core letters indicating the pump service and number, e.g. "Boiler Feed Pump No. 1", "Boiler Feed Pump No. 2".
- (d) Pumps and motors shall be tested for operating characteristics and the report of these tests, performance and required net positive suction head curves and complete shop drawings shall be submitted for approval. Pump data shall include make and model number, design and actual gpm, bhp, maximum shut off and design head, rpm, suction and discharge pressure. Motor data shall include make and model number, hp, rpm, NEMA Code letter, full load current and voltage.
- (e) Boiler feed pumps shall be Armstrong Pumps, Inc. Series 4023 Type "MSH", Bell & Gosset Co. Series 1510 Universal pump, Dunham-Bush Inc. Type B-9, Taco Inc. "SB" Series, or equal complying in all respects with the requirements of the drawings and the specifications.

15B-14.00. Boiler Feed Pumps-(Cont.)

- (f) 1. HVAC Contractor shall also furnish and install a closed type panel for the electric control of the boiler feed pumps. The panel shall be fabricated from sheet steel to meet Code requirements and shall be securely mounted on the wall at the location indicated on the drawing. The panel shall be fitted with a hinged door and latch. Steel work of the panel shall be painted with one coat of red oxide paint and one coat of aluminum paint.
2. Provide and install within the control panel the following equipment: One magnetic starter for each pump with thermal overloads and with disconnect switch on or near starter; one hand-off-automatic switch for each pump; one pump selector switch; any transformers, relays, etc., as required. Make all wiring connections between control panel equipment and the pumps, motor operated boiler feed valves, and feed pump controls (specified in Section 15B-6) to make the system function as designed. Only one pump shall operate at a time. Others will bring a main line (3-phase, 4-wire 120-208V) feeder to the control panel and this Contractor shall make the connection to the panel. Each item of electrical equipment shall be identified on the panel by means of a nameplate, as specified in Par. (c), stating its use. A similar nameplate with  $\frac{1}{2}$ -inch letters shall be installed on the outside of the panel.
3. Contractor shall include among the shop drawings specified in Par. (d), drawings of the control panel, showing physical dimensions, as well as a complete wiring diagram of the panel and the related control equipment, and a sequence of operation for the system. A copy of the wiring diagram shall be mounted on the inside of the panel door.

15B-14.01. Condensate Receiving Tank

- (a) Furnish and install a condensate receiving tank of size and capacity and in the location indicated on the drawings. Tank shall be designed for steam working pressure of 15 psig and shall conform to requirements of ASME Construction Code for Unfired Pressure Vessels. Tank shall be installed complete with supports, piping, valves, red-lined gauge glass with shut-off valves, make-up water feeder, gauges, thermometer, air gap fitting, low water cut-off, etc. Exterior of tank shall be factory coated with red oxide or other corrosion resisting paint. Gauges and thermometer shall comply with Section 15B-11.

15B-14.01. Condensate Receiving Tank-(Cont.)

- (b) Provide and attach by welding, four (4) 1½"x1/8" steel flat bars spaced approximately 90° apart along the full length of the tank. The bars, which shall be used in the field installation of insulation block, shall have 1/8" diameter drilled or punched holes on 12-inch maximum centers.
- (c) Provide and install a 12-inch diameter access opening with bolted cover, secured to a 3½-inch (minimum height) flanged frame, in the top of the tank. Cover shall be of ¼-inch thick steel and shall have a handle welded to the top surface. Cover shall be installed with a gasket of non-asbestos material and shall be secured with eight 3/16-inch diameter steel hex bolts and nuts. In the bottom of the tank, furnish and install a 1-inch I.P.S. drain tapping, fitted with a 1-inch hose gate valve (the equal of Kennedy Valve Co. Figure 29).
- (d) Make-up feeder shall maintain suitable water level in tank. It shall be float operated, with integral strainer and with monel bellows isolating the float chamber from the valve assembly. It shall also provide an air gap between the receiving tank and the city water supply. Feeder shall be set so that its closing level is set at a height above the bottom of the tank, a distance equal to 1/3 the height of the tank. Water feeder shall be McDonnell & Miller, Inc. No. 551 S, or other approved equal.
- (e) Low water cut-off shall be wired into the pump control circuit to prevent feed pump from operating if the level of water in the tank drops below a point 6-inches above the bottom of the tank. Low water cut-off shall be McDonnell & Miller, Inc. No. 63, or other approved equal.
- (f) Air gap fitting on the tank shall be a galvanized cast iron fitting with threaded inlet and outlet, and with air gaps to prevent contamination of the city water supply system. It shall be Josam Mfg. Co.'s No. 1800, J.R. Smith Co.'s Series 3952, or other approved equal.
- (g) Submit complete shop drawings of tank (indicating plate thickness, tappings, etc.), water feeder, low water cut-off and air gap fitting for approval.

Note: The use of a factory assembled boiler feed pump unit embodying all of the components as specified in Par. 15B-14.00 and 15B-14.01, and completely piped and wired may be accepted. The assembly shall be mounted on a structural steel frame which shall be factory painted with one coat of red oxide paint and with a coat of aluminum paint. The approved assembly shall be installed on a 4-inch high concrete base furnished by this Contractor. Submit complete shop drawings for approval.

SECTION 15B-15  
FANS, AIR HANDLING AND TREATMENT

15B-15.00. General Requirements

(a) Type and Construction

1. All fans, excepting where otherwise specified, shall be of the multi-blade backwardly inclined centrifugal type, single or double inlet for rotation as shown on the drawings. Fans shall be located where shown on the drawings and erected, together with the driving motors, all as specified hereinafter. Excepting the roof and propeller type fans, all fans shall be supported on vibration absorbing supports specified in Paragraph 15B-22.09. Unless otherwise called for, all fans with wheel diameter greater than 27-inches shall have arrangement No. 3 and those with 27-inch or smaller wheel diameter shall have Arrangement No. 2.
2. Each fan shall bear the Certified Ratings Performance Seal of the Air Moving and Conditioning Association (AMCA).
3. Contractor shall examine the drawings, visit the site, and take measurements to make sure that the equipment will fit in the spaces allocated, and that the equipment can be brought through the passages and the doors of the fan rooms. Fans too large to pass through these passages and doorways, shall be shipped "knocked down" and assembled in the fan rooms.
4. Provide belt drive guard as specified in Par. 15B-17.27.

(b) Housing

Side sheets and scroll sheet shall be assembled by means of a continuous fillet weld at the junction of the side sheet and the scroll sheet. Stiffening and base members shall also be secured by welding. For fans having wheel diameters 36-inches or less, the side sheets may be secured to the scroll sheets by a continuous, deep, smooth, machine-made lock-seam. Fan inlet shall be cone shaped to provide smooth air flow to the wheel. Each fan shall have the direction of rotation permanently marked on the drive side sheet by means of an embossed or stamped metal arrow.

15B-15.00. General Requirements-(Cont.)

(c) Wheels

Wheels shall be of the backwardly inclined type with a full non-overloading power characteristic and shall be properly braced with reinforcing rings and brace rods as required. Blades shall be welded to the backplate and to the rim. Welds shall be continuous, fillet type. Wheel rims shall be of one piece spun construction so shaped as to assure smooth air flow and efficient, stable performance. Fan wheels with airfoil type backwardly inclined blades welded to backplate and wheel cone also are acceptable. Hubs for each wheel shall be either a heavy cone-shaped casting or a heavy machined steel hub welded to a steel plate which shall be secured to the back plate. Hub shall be bored to fit shaft exactly and shall be securely fastened in place by a heavy taper steel key and a case hardened steel set screw.

(d) Shafts

Each fan shall have a turned, ground and polished steel shaft.

(e) Bearings

Each fan shall be equipped with either oil lubricated babbitted sleeve bearings or with grease lubricated ball (or roller) bearings, in accordance with the following requirements.

1. Sleeve Bearings.

These bearings shall be lined with the best grade babbitted metal and shall be self-lubricated by means of ring oilers. An oil cup and an oil gauge, with shield, shall be provided for each bearing and shall be installed in an accessible location. Graphite impregnated bearings will not be accepted. Wearing surfaces of each bearing shall be self-aligning, easy of adjustment and large enough to operate with minimum heating. They shall be enclosed in heavy wrought or cast iron standards, securely bolted in place. Bearings on the drive side of fans shall be non-expansion type, and those on the opposite side shall be expansion type. Sleeve bearings shall be Dodge Manufacturing Corp. Sleeveoil Plain Pillow Blocks or equal.

15B-15.00. General Requirements-(Cont.)

2. Ball or Roller Bearings

- A. These bearings shall be designed for heavy duty service. Bearings on drive side of fans shall be non-expansion type, and those on the opposite side shall be expansion type. Bearings shall be self-aligning pillow-block type with either single row ball or double row spherical roller in one-piece or two-piece cast iron housing.
- B. Fan manufacturer shall certify that bearings being furnished have been selected in accordance with bearing manufacturer's recommendation for a minimum B-10 life of 40,000 hours (average life of 200,000 hours), based on the optimum speed range of the fan's AMCA class. Calculations of bearing manufacturer shall be supplied, if required.
- C. Each bearing shall be equipped with a lubrication pressure fitting, provided with pressure relief feature to prevent excessive pressure build-up on the seals. Contractor shall furnish to the Custodian one pound of recommended lubricant for each fan, and one lubrication gun for the entire project.
- D. Each fan having a wheel diameter of 27-inches or less (Arrangement No. 2) shall have two ball bearings, either in a single pillow block or in separate pillow blocks.
- E. Bearings shall be made by Dodge Manufacturing Co., Fafnir Bearing Co., Link-Belt Co., Sealmaster, or SKF Industries.

(f) Balancing

Each fan wheel shall be factory balanced statically and dynamically and shall be given a running test as an assembled unit prior to shipment.

(g) Painting and Protection

- 1. Fans shall be primed and sprayed at the factory with zinc chromate or red oxide paint. The metal shall be thoroughly cleaned by sand blast prior to spraying, on all inside and outside surfaces, excepting the bearings, nameplates, etc. Bright parts shall be slushed with a protective compound and protected prior to erection.
- 2. Fans shall be finish painted after erection at the site as specified in Section 15B-21.

15B-15.00. General Requirements-(Cont.)

(h) Name Plates

In addition to the manufacturer's name plate furnished with each unit giving data as to size, style, name, etc., there shall be accessibly located on each unit, a name plate made of 1/8-inch thick black beveled plastic laminate with 1/2-inch high white core letters giving the system name and fan number. Name plates shall be fastened with oval head brass screws and shall be located on fans where they may be easily read from floor. Requirements of this paragraph shall apply to all air moving equipment.

15B-15.01. Shop Drawings

HVAC Contractor shall submit detail drawings of all types of fans, prepared by the respective manufacturers. These detail drawings shall show complete compliance with the drawings and the specifications.

15B-15.02. Unit Type Utility Fans

(a) General

Unit type fans shall be specially designed for compact arrangement. When the fan is located on a roof, the motor, etc. shall be enclosed in a weatherproof sheet steel cover, and the motor shall be provided with a disconnect switch as specified in Par. 15B-15.05(f). Inside motor bearings shall be made easily accessible for lubrication by means of extended piping, or by an access door.

(b) Belt-Driven Fan Sets

Special brackets shall be provided for support of motor with the motor pulley immediately below the fan pulley. Motors for belt driven unit type fans shall be equipped with variable pitch sheaves, as specified in Paragraph 15B-15.20. Unit type fans shall have approved ball bearings contained in two pillow blocks mounted on a pedestal (Arrangement No. 1). Pulleys, belt and motor shall be protected with removable wire mesh or sheet steel cover.

(c) Direct-Connected Fan Sets

Casings of direct-connected fan sets shall be welded sheet steel construction. Wheels for these sets may be of cast or sheet aluminum or sheet steel, but in either case shall be carefully balanced to prevent undue noise when operating. Motors for direct-connected fan sets may be specially designed ball bearing, with flange arranged to bolt motor to fan casing, so that motor shaft will set horizontally; or motor may be of the standard horizontal type, mounted on a support, rigidly and securely



15B-15.02. Unit Type Utility Fans-(Cont.)

attached to fan casing. In either type, fan wheel shall be securely mounted on extended motor shaft.

15B-15.03. Fan Capacities, Etc.

(a) General

The volume of air delivered or exhausted, static pressure, speed, wheel diameter and brake-horsepower for each fan, together with the minimum horsepower and speed of its motor, shall be in accordance with the tabulations on the drawings.

- (b) Each fan shall be capable of delivering (or exhausting) the required air volume against the stipulated static pressure when developing not more than the brake-horsepower called for that unit. A decrease of five percent (5%) in fan wheel diameter will be accepted, provided that the resultant tip speed at stipulated air delivery is not exceeded by more than ten percent (10%) and the stipulated brake-horsepower is not exceeded. Outlet velocities shown on the drawings shall not be exceeded by more than five percent (5%).

15B-15.04. Approved Makes of Centrifugal Fans

Fans manufactured by Aladdin Heating Corp., American Standard Industrial Products Division, Barry Blower Co., Buffalo Forge Co., Champion Blower & Forge Co., Chicago Blower Corp., New York Blower Co., H.K. Porter Co., Inc. (Peerless), Sturtevant Division of Westinghouse Electric Co., Trane Co. or Zurn Industries, Inc. (Clarage Division) conforming with the requirements of the drawings, specifications, and job conditions will be approved.

15B-15.05. Roof Type Exhaust Fans

(a) General

Roof type exhaust fans shall be of the power roof ventilator type, complete with motor, frame, housing, etc. The fan wheel shall be aluminum. All other parts of the fan with which the air stream comes in contact shall be aluminum, stainless steel or reinforced fiber glass polyester plastic. The use of a heavy gauge steel motor support plate, protected with a baked enamel or equal finish, may be accepted.

15B-15.05. Roof Type Exhaust Fans-(Cont.)

(b) Installation

Each roof exhaust fan shall be mounted by the HVAC Contractor on a concrete curb provided by the Contractor for General Construction. The concrete curb will enclose the opening in the roof for the exhaust flue, and will be furnished with flashing and with a wood sill at the top. The exhaust fan shall fit properly over the sill and shall be secured to it with stainless steel lag screws. The joint between the fan base and the sill shall be made air tight by means of heavy roofing felt or other approved counter flashing material.

(c) Fan Unit

1. The fan shall be capable of exhausting the cubic feet of air per minute with the static pressure, minimum wheel diameter and speed shown on the drawings. After assembly of motor and wheel, the rotating parts shall be statically and dynamically balanced at rated speed to provide vibration free operation.
2. The fan shall be quiet operating, backward curved centrifugal, non-overload type, provided with approved type belt drive. Direct-connected fans shall be furnished only when so indicated on the drawings. Fan drives shall be sized in accordance with the recommended practices of the drive manufacturer. Belts shall be selected for at least 50% excess motor horsepower. Motor shall have an adjustable pitch driving sheave, and shall be located in a compartment separated from the air stream. The motor shall be of size and characteristics noted on the drawings, shall be equipped with a terminal box, and shall comply with the requirements of Section 15B-16. Wheel and motor support assembly shall be of heavy gauge aluminum, galvanized steel, or steel which has been thoroughly coated with approved corrosion resisting paint. Fan and motor shall be supported on vibration isolation mounts. The fan shall be provided with an inlet ring or core.
3. The frame of the unit shall be made of aluminum or stainless steel of suitable thickness to insure structural integrity of the unit. The entire unit shall be designed to provide for easy removal of the fan, motor, etc., without disturbing the balance of the unit.

15B-15.05. Roof Type Exhaust Fans-(Cont.)

(d) Housing

The fan unit shall be provided with a closed weatherproof housing of one of the types indicated below. All roof exhausters for a project shall be of the same type. All hardware, screws, etc., used in the construction of the fan housing shall be of stainless steel or non-ferrous material. Housing shall be provided with one (1) brass or cadmium plated padlock where the hood is hinged, or two (2) padlocks where the hood is removable. Three (3) master keys for all padlocks shall be furnished and delivered to the Custodian. Housing shall be of such design as to form a uniform passage for air all around the rim. The air discharge openings shall be provided with wire mesh screens of ½-inch mesh of No. 16-gauge copper, bronze, aluminum or PVC encapsulated bird guard with brass or aluminum screws. Screens shall be securely fastened in place with aluminum, brass or stainless steel clips or fasteners. Where the fan design includes an integral wiring conduit, it shall be large enough to permit passage of a 3/4-inch conduit through it. Where an integral wiring conduit is not included, openings for the passage of 3/4-inch conduit (for service wiring by others) from base of fan into motor compartment shall be provided by the fan manufacturer. Low silhouette type housings are not acceptable. Approved type housings are:

1. Spun Aluminum

This type housing shall be fabricated from not less than No. 14-gauge aluminum in wheel sizes less than No. 30. The top cover for size No. 30 shall be not less than No. 14-gauge and the skirt, support base and curb shall be not less than No. 12-gauge. For size No. 36 fan, the cover, skirt and curb shall be not less than No. 12-gauge, and the support base shall be not less than No. 10-gauge. For size No. 48 fan, the cover shall be not less than No. 12-gauge, skirt and curb shall be not less than No. 10-gauge and the support base shall be not less than No. 8-gauge. Die formed housings may be accepted, provided that gauges of aluminum used are approved by the Executive Director.

15B-15.05. Roof Type Exhaust Fans-(Cont.)

2. Reinforced Plastic

This type housing shall be dome-shaped, molded and bonded reinforced fiberglass polyester plastic. Sizes less than No. 21, shall have the housing made from not less than 3/32-inch thick plastic. Fan size No. 21 and larger shall be of greater thickness but not less than 1/8-inch.

(e) Thermal Overload Protection

Motors for roof exhaust fans shall not be provided with thermal overload protection, since the Contractor for Electric Work will provide a starter with thermal overload protection and a pilot light for each roof exhauster motor.

(f) Disconnecting Switch

Each roof type exhauster with 2-horsepower or smaller motor shall be provided with an approved disconnecting switch in general purpose enclosure mounted inside of the housing near the motor. Wiring between motor and switch shall be installed by the fan manufacturer in 1/2-inch (minimum size) Greenfield conduit. Disconnect switch shall be positioned in a location easily accessible for field connection of service wiring by others. Conduit outlet from switch shall be 3/4-inch. Disconnect switches for single phase motors shall be 2-pole, the equal of Arrow-Hart No. 6808; for three phase motors, they shall be 3-pole, the equal of Arrow-Hart No. 7810. Other disconnect switches are subject to approval. Submit sample, if not already approved. Disconnect switches for roof type exhausters having larger than 2-horsepower motors will be furnished and installed within the fan housing by the Contractor for Electric Work.

(g) Dampers

When shown on the drawings, self-acting aluminum louver dampers shall be provided in the inlet to the fan, mounted on an aluminum angle frame. All parts of the self-acting dampers shall be constructed of non-ferrous metal. The use of nylon bearings may be accepted. Where automatic motor operated dampers are required, the motors and dampers shall be furnished and installed by the manufacturer of the temperature control system.

15B-15.05. Roof Type Exhaust Fans-(Cont.)

(h) Extension for Damper

Every roof exhauster shall have an extension base at least 6-inches high. Except for fans serving as kitchen range hood or warming pantry exhausters, each 6-inch extension base shall have a 12-inch by 4-inch inspection opening with gasket and No. 14-gauge aluminum cover plate in one side of the base. Extension bases for fans with motor operated dampers shall be at least 12 inches high and shall have a weather protected access panel, with handle, of ample size to permit removal of damper unit in one side of the extension. Extension base shall be fabricated from not less than No. 14-gauge aluminum sheets and shapes and shall form a rigid structural member for the fan and housing mounted upon it. Extension shall fit the roof curb and shall be secured thereto in the manner specified for the fan unit in Par. (b).

(i) Insulated Plate

A roof type exhaust fan used with a kitchen range hood or a warming pantry hood exhaust system shall be equipped with means of insulating the motor compartment from the heat of the exhaust fumes. This shall consist of a double top plate having a layer of non-asbestos insulating material between the plates, and sealing the shaft opening through the plates. Insulating material shall be suitable for temperatures up to 1200<sup>o</sup>F., and shall be the equal of Carborundum Co.'s "Fiberfrax Duraboard" or Johns-Manville's "Cerawood Millboard". Motor compartment shall be fumeproofed by providing a packing gland on the fan shaft and by sealing around the electric conduit opening and the perimeter of the top plate. Details of alternate methods of isolating the motor compartment shall be submitted for approval.

(j) Bearings

Bearings shall be heavy duty self-aligning ball bearing type, either permanently lubricated or equipped with fittings for grease lubrication. In the latter case, a grease gun of the proper type shall be furnished and delivered to the Custodian.

(k) Approved Makes

Roof type exhaust fans shall be manufactured by Acme Engineering & Manufacturing Co., Aladdin Heating Corp., Greenheck Fan Corp., Jenn-Air Products Co., or Zurn Industries Inc.-Swartwout Division, and shall conform to the requirements of this specification and the drawings. Each fan unit shall bear the Certified Rating Performance Seal of the Air Moving and Conditioning Association (AMCA).

15B-15.06. Wall Type Exhaust Fan

When indicated on the drawings, furnish and install in the location shown, a centrifugal wall type exhaust fan complete with gravity shutter damper, motor, etc. Fan and motor shall comply with the data indicated on the drawings. Housing shall be heavy gauge spun aluminum with stainless steel fastenings. Motor shall be totally enclosed, single speed type. This Contractor shall be responsible for making the opening through the wall and for the installation of the sleeve, duct, and fan in a weathertight manner. Wall switch and electric wiring external to the fan will be provided by the Contractor for Electric Work. Fan shall be Acme Engineering & Manufacturing Co.'s "Centrimaster", Aladdin Type "W", Greenheck Fan Corp., Jenn-Air Products Co.'s CW series, or other approved equal.

15B-15.08. Unit Ventilators (Floor Mounted)

(a) General

Furnish and install in each location shown on the drawings, a floor mounted unit ventilator of the type (heating only or heating-cooling) and capacity indicated. Air capacities shown are in terms of CFM standard air. Unit ventilators shall be certified as tested and rated for air delivery in accordance with ASHRAE "Standard Code for Testing and Rating Steam Unit Ventilators". When delivering the required amount of air, each unit ventilator shall operate at a noise level well below the point of interference with the educational functions of the room in which the unit is located. Sound power test data shall be submitted for approval, if required by the Executive Director.

(b) Cabinet

Unit ventilator cabinet shall be fabricated of not lighter than No. 14-gauge cold rolled steel supported on a steel frame. Cabinet shall be of height indicated on drawings and shall include a piping enclosure, at least 8-inches in width, at each end. All corners and edges shall be rounded. Removable panels shall be provided to furnish access to the interior of the unit. Fasteners for such panels shall be of the spring loaded type, or other approved, with Allen head. End panels shall be provided where the depth of the adjacent fill-in section is less than that of the unit ventilator. Discharge and recirculation grilles shall be bar type of heavy gauge aluminum or steel. Discharge grille shall be of the double deflecting type. (A series of individually adjustable vanes shall be provided behind the face bars, for this purpose.)

15B-15.08. Unit Ventilators (Floor Mounted) - (Cont.)

(c) Fill-in Sections

Where indicated on the drawings, fill-in sections shall be provided to fill the space between the unit ventilator and an adjacent column, storage cabinet and the column, or to enclose a wall face column. Fill-in sections shall be constructed of not lighter than No. 16-gauge steel and shall be of the same height and depth as the unit ventilator or storage cabinets, to form a continuous front and top. They shall be finished the same as the unit ventilator and shall have a top of laminated plastic. Front of fill-in sections shall be lined with sound deadening material and shall be removable to provide access to control valves, piping, etc. Measurements for the fill-in sections shall be obtained at the job.

(d) Painting

All steel parts of each unit ventilator, storage cabinet, and fill-in section shall be subjected to a phosphating, bonderizing or equal treatment to improve the finish bond, to resist corrosion and to prevent rust from starting under the surface. After this surface treatment, each external casing, storage cabinet and fill-in section shall be finished with a hard baked enamel finish in a color to be selected by the Executive Director. Recessed kick-plate at base shall be painted black.

(e) Fans

Fans shall be forward curved centrifugal type, directly or belt driven. Means shall be provided to change the fan speed by changing the motor speed or by means of a variable pitch sheave on the motor. Fan and motor bearings shall be designed for infrequent lubrication. Each motor shall be equipped with built-in thermal overload protection and with a disconnect switch, or circuit breaker, of proper size located within the unit. All wiring within the unit ventilator shall be in accordance with the N.Y.C. Electrical Code.

(f) Switch

Each unit ventilator shall be provided with a key-operated on-and-off switch, located within the casing, accessible to the exterior for operation. A toggle switch located within the casing and adjacent to a locked access door, also is acceptable for this purpose. A junction box shall be provided to receive the electric service wiring. Contractor for Electric Work will provide the electric service wiring to each unit ventilator.

15B-15.08. Unit Ventilators (Floor Mounted) - (Cont.)

(g) Dampers

1. Heating Unit Ventilator

Each heating unit ventilator shall be equipped with mixing and shut-off dampers arranged for automatic control. Each damper shall have replaceable mohair, or equal, seals on the damper edges. Dampers shall operate under automatic control to:

- A. Prevent the entry of outdoor air during shut-down period and to provide complete recirculation during warming-up period.
- B. Admit a mixture of indoor air and a fixed minimum percentage of outdoor air when required.

2. Heating-Cooling Unit Ventilator

Each heating-cooling unit ventilator shall be equipped with outside air, recirculation air, and with face and bypass dampers. Each damper shall have replaceable mohair, or equal, seals on the damper edges. Dampers shall operate under automatic control as follows:

- A. Unit shall provide full heating or full cooling capacity when the face and bypass damper has been positioned for full air flow through the coil.
- B. When heating or cooling is not required, and the unit is providing outside ventilation air, the face and bypass damper shall be so positioned that all air bypasses the coil.

(h) Outdoor Air Intake Wall Box

Outdoor air intake wall box for unit ventilator shall be constructed of aluminum and shall consist of a 0.064-inch (minimum) frame and 0.050 inch (minimum) vertical weather louvers. It shall be designed to prevent the entrance of rain beyond the louver section. The assembly of frame and louvers shall be not less than 2-inches deep in the direction of air flow. Unit ventilators must be positively guaranteed against blow-through and outside air leakage. Each unit shall be equipped with a series of movable vanes, stabilizers, back-check dampers or other devices accessible from the room for servicing, designed to prevent excess air from blowing through



15B-15.08. Unit Ventilators (Floor Mounted)-(Cont.)

from outside into the room through the recirculation air grille due to fluctuations in wind pressure. The wall box shall be provided by the HVAC Contractor and delivered to the Contractor for General Construction (who will install it) in ample time to prevent delay in construction of the exterior wall. The outside face grille will be furnished and installed by the Contractor for General Construction.

(i) Coils

1. Coils for Heating Unit Ventilators

Coils for heating unit ventilators shall be of the non-freeze steam distributing type, with seamless copper tubes and copper or cast semi-steel headers. Condensing tube shall be 3/4-inch (minimum) O.D. Tubes shall be fitted with aluminum fins mechanically bonded to the tubes. Coils shall be provided with side plates to protect the fins from damage. Where cast semi-steel headers are used, tubes shall be rolled and bushed into the header. Where copper headers are used, the tubes shall be silver brazed to each header.

2. Coils for Heating-Cooling Unit Ventilators

Coils for heating-cooling unit ventilators shall be suitable for use with a hot water/chilled water two-pipe system. Coils shall be made of 3/8" (minimum) O.D. copper tubes, with copper return bends, expanded into aluminum plate type fins. Coils shall be mounted in a heavy steel frame to prevent the element from sagging. Means to vent and drain coils shall be provided. A fully insulated corrosion-protected drain pan shall be installed beneath the coil. Pan shall have a 3/4-inch minimum size drain connection to provide for the disposal of the condensate to the drainage system.

(j) Air Filters

Each unit ventilator shall be equipped with air filter (s) so located within the unit that all air is filtered before it contacts the coil. Filters shall be readily accessible for removal from the unit. Filter media shall be 5/8-inch minimum thickness polyurethane having 20 pores per lineal inch, or other approved washable material, contained in a permanent metal frame. Furnish a complete spare filter for each filter in the unit ventilator.

15B-15.08. Unit Ventilators (Floor Mounted) - (Cont.)

(k) Controls

Unit ventilators shall be automatically controlled in the manner specified in Section 15B-19. Damper motors, electric-pneumatic switches and discharge air stream thermostat, furnished by the temperature control manufacturer, shall be factory installed within the unit by the unit ventilator manufacturer. Air piping for controls shall be copper tubing as specified in Par. 15B-8.00(f).

(l) Installation

Unit ventilator shall be set level by means of leveling legs and shall be bolted to the wall and/or floor as recommended by the manufacturer. The backs of the unit and accessories shall have a rubber, fiber glass or urethane foam seal strip to insure an air tight seal between the equipment and the wall. Where required, a felt pad shall be provided to seal between the bottom of the unit and the floor.

(m) Each unit ventilator shall maintain a factory trained service staff within the N.Y.C. metropolitan area. He shall provide the services of this staff at the time the installation of his equipment has been completed to insure that the equipment has been installed in accordance with his instructions and to check its performance. This staff shall also check the performance of the equipment prior to the expiration of the one year warranty period, preferably during the twelfth month of operation. At this time, all electric connections, fan speed, quantity of air delivered and lubrication of unit shall be checked, and instructions in servicing the units shall be given to the Custodian. The manufacturer shall give written notice to the Contractor that he has complied with the foregoing provisions and the Contractor shall forward this notice to the Executive Director.

(n) Approved Makes

Unit ventilators shall be manufactured by American Air Filter Corp. (Herman Nelson), Trane Co. or other approved and shall comply with the requirements of the specifications, the drawings and space conditions. Submit complete shop drawings for approval.

15B-15.09. Unit Ventilators (Ceiling Mounted)

Where the drawings indicate a ceiling mounted unit ventilator to be installed; it shall be essentially as specified in Par. 15B-15.08, except that the access panels shall be hinged, and the unit shall be supported from overhead structural members. Number, type, and location of hangers shall be in accordance with the recommendations of the unit ventilator manufacturer. Indicate same on shop drawings.

15B-15.10. Storage Cabinets

- (a) Where the drawings show storage cabinets adjacent to floor mounted unit ventilators, HVAC shall furnish and install closed and/or open storage cabinets, as indicated. Storage cabinets shall be constructed of not lighter than No. 16-gauge steel. The ensemble shall consist of steel storage cabinets, discharge grilles, insulation, combined with continuous non-ferrous finned radiation (where shown on drawing), arranged so that air circulates through the front under the bottom fixed shelf and discharges through the outlet grille at the top rear of the cabinet. Finned radiation shall be as specified in Paragraph 15B-12.04.
- (b) Front and top storage cabinets shall align with front and top of unit ventilator, allowing for finned radiation behind cabinets; submit complete, coordinated details for approval. Storage cabinets shall be not less than 12-inches in depth. They shall be finished the same as the unit ventilator. The top shall be of high pressure laminated plastic (formica or approved equal) in a color and pattern selected by the Executive Director and shall have a metal nose trim at the front edge. Each cabinet shall contain one adjustable shelf. The sliding doors shall be of double panel construction, and shall be equipped with a lock. The locks for the cabinets shall be keyed alike and a total of 15 keys shall be furnished. The back of the storage cabinets shall have a ½-inch thickness of rigid insulating board applied to the exterior surface. Means shall be provided to secure the cabinets to the wall and to each other in alignment, and the cabinets shall be equipped with adjustable leveling devices.

15B-15.10. Storage Cabinets-(Cont.)

- (c) The outlet grille shall be bar-type, stamped from No. 16-gauge steel or extruded aluminum to match unit ventilator grille, and shall be supported from the cabinet as shown on the drawings. The grille shall be continuous for the entire length of finned radiation, and the ends of the grille section (beyond the limit of the finned radiation) shall be blank. The grille shall be finished to match the storage cabinet. Where the drawings indicate that no heating element is to be installed behind the cabinets adjacent to the unit ventilator, the grille shall be blank and shall be continuous behind the unit ventilator as indicated on the drawing.
- (d) For uniformity of appearance, color matching and single responsibility for proper performance, storage cabinets, finned radiation together with support brackets, safing, grilles, etc., shall be furnished by the manufacturer of the unit ventilator.
- (e) Fill-in sections shall comply with the requirements of Paragraph 15B-15.08.

15B-15.11. Cabinet Heater

- (a) Furnish and install, in the location indicated on the drawings, a single speed recessed cabinet heater with the characteristics given in the data. Heater shall have a steel enclosure front of not lighter than No. 14-gauge, with integral inlet and outlet grilles. Front panel shall overlap wall opening on all sides and shall have a gasket at the edges. Panel fasteners shall be of the spring loaded type, or other approved, with Allen head. Entire cabinet shall be protected with rust inhibitive paint and finished with baked enamel, applied after bonderizing. Color of front shall be as selected by the Executive Director. Heater shall be installed complete with steam and return piping, valve, trap, etc. Heater blower motor shall be controlled by means of an electric thermostat.

Note: The Contractor shall furnish a steel frame, of proper size, similar in construction to the "Type A" frame shown on the Standard Detail, for each recessed cabinet heater. He shall deliver the frame to the Contractor for General Construction, who will install it, in ample time to prevent delay in the construction of partitions, furring, etc. Frame shall be given a shop coat of red oxide paint or zinc chromate paint. Where required, cut-outs shall be made in the bottom of the frame to allow for piping connections. The recessed cabinet heater shall be secured to this frame.

15B-15.11. Cabinet Heater-(Cont.)

- (b) Cabinet heater shall be complete with proper size heating element, two or more fans with housing, motor, motor control, etc. all factory assembled. Fans shall be mounted on a heavy gauge steel assembly board, and shall be directly or belt driven with variable pitch pulley on the motor shaft. Thermal overload protection for the motor shall be provided. No filters are required.
- (c) Controls, including a wall mounted electric thermostat, control circuit transformer, limit controller and motor starter shall be provided. Thermostat shall be 24-volt type, the equal of Honeywell's model T6051A, and shall be equipped with locking cover and metal protective guard. It shall be installed approximately 7-feet above the floor in the location shown on the drawing. Thermostat shall control the heater blower operation. Control circuit transformer shall be installed within the cabinet heater and shall provide a 24-volt circuit for the thermostat. The limit controller, the equal of Penn Controls A19DAC, shall be installed after the trap on the return piping from the heating coil. The limit controller shall act to prevent the operation of the blower motor unless there is steam in the heating coil. The motor starter shall be installed within the cabinet and shall be equipped to perform with the other control devices as specified herein.
- (d) The Contractor for Electric Work will provide service wiring to the starter and control wiring to the thermostat and to the limit controller. Wiring between the starter and the blower motor shall be provided by the cabinet heater manufacturer. HVAC Contractor shall supply a copy of the unit's wiring diagram to the Contractor for Electric Work.
- (e) Cabinet heater shall be manufactured by American Air Filter Co., Trane Co., or other approved manufacturer complying in all respects with the requirements of the specifications, drawings and space condition. Submit complete shop drawings for approval.

15B-15.12. Fan Coil Units

- (a) Furnish and install fan coil units of the capacity and in the locations indicated on the drawings. Air capacities shown are in terms of CFM standard air.
- (b) Each cabinet shall be fabricated from galvanized steel, supported on a steel frame. Removable panels shall be provided to furnish access to the interior of the unit. All painted surfaces shall be chemically cleaned, and finished in baked enamel of color as selected. Discharge and recirculation grilles shall be of aluminum or painted steel. Discharge grille shall be double deflecting type, and shall be located in the top of the unit. A gasket seal shall be installed between the unit and the adjacent wall.
- (c) Fans shall be forward curved centrifugal type, directly or belt driven. Bearings shall be designed for infrequent lubrication. Each fan coil unit motor shall be equipped with a fused disconnect switch, or circuit breaker, of proper size located within the unit. Each unit shall also be equipped with a speed selector switch, mounted within the unit and factory wired. Contractor for Electric Work will provide service wiring to the unit.
- (d) Fan coil unit shall be furnished with an outside air intake louvered wall box of heavy gauge aluminum, which will be installed by the General Construction Contractor. Wall box shall be provided with a bird screen. Each unit shall have a factory installed outside air damper adjustable for admission of 0% to 25% outside air. Damper shall open when fan motor is started.
- (e) Heating-cooling coil shall be made of copper tubes expanded into aluminum plate type fins. Coil shall be suitable for use with a hot water/chilled water two-pipe system. Coil shall be mounted in a heavy steel frame to prevent the element from sagging. Means of venting and draining the coil shall be provided. A fully insulated corrosion-protected drain pan shall be installed beneath the coil. Pan shall have a 3/4-inch minimum size drain connection to provide for the disposal of the condensate to the drainage system.
- (f) Fan coil unit shall be controlled in the manner specified in Section 15B-19. Outside air damper motor, electric-pneumatic switches and discharge air stream thermostat, furnished by the temperature control manufacturer, shall be factory installed within the unit by the fan coil unit manufacturer.

15B-15.12. Fan Coil Units-(Cont.)

- (g) Each fan coil unit shall be equipped with an air filter so located that all air is filtered before it contacts the coil. Filter media shall be 5/8-inch minimum thickness polyurethane having 20 pores per lineal inch, or other approved washable material, contained in a permanent metal frame. Furnish a complete spare filter for each filter in the unit.
- (h) Fan coil units shall be manufactured by American Air Filter Co. (Herman Nelson), or Trane Co., complying with the requirements of the drawings and specifications. Submit complete shop drawings for approval.

15B-15.13. Heating and Ventilating Blower Unit

(a) General

Heating and ventilating blower unit shall be of the draw through type with the characteristics tabulated on the drawings. Unit shall contain heating element, filter, fan, motor, V-belt drive with guard, etc. all assembled, encased and tested at the factory. Unit shall be connected with ductwork and piping as shown on the drawing and as specified.

(b) Heating Element

Heating element shall be of non-freeze design and shall comply with the requirements of Par. 15B-15.17.

(c) Fan

Unit shall be provided with a forward curved fan with housing, and shall be arranged for belt drive. Fan shall be statically and dynamically balanced. Extended lubrication tubing shall be provided for bearings located within the casing. Belt drive shall be equipped with a removable guard. Guard shall consist of combination sheet steel and expanded metal which totally encloses the V-belts and sheaves. The front shall be of expanded metal and shall have a tachometer opening, with cap plug, located at the fan sheave. Back of guard shall be of solid sheet steel of appropriate gauge, holed to accommodate fan and motor shafts. Fan bearings shall comply with the requirements of Par. 15B-15.00 (e).

(d) Motor

Motor for unit shall comply with the requirements of Section 15B-16. Motor shall be provided with self-aligning bearings which shall be externally mounted. Bearings shall be designed for heavy duty performance and shall insure quiet operation. Motor mountings shall be adjustable. Provide thermal overload protection for motor.

15B-15.13. Heating and Ventilating Blower Unit-(Cont.)

(e) Casing

Casing for unit shall be fabricated of steel, well reinforced with angle or channel shapes to provide a rigid structure. "Pan type" construction may also be accepted, subject to approval by the Executive Director. Removable steel panels shall be provided to furnish easy access to all internal equipment. Units installed in fan rooms, pipe and duct spaces, etc., may have galvanized steel finish. Those installed in finished areas shall be protected with a rust inhibitive paint and finished with oven baked enamel applied after bonderizing.

(f) Support

Unit shall be mounted on vibration isolating supports as specified in Par. 15B-22.03. Each isolating support shall be secured to a bearing plate welded to the top flange of a steel beam furnished by this Contractor. Two such beams shall be provided, one under each side along the length of the blower unit and extending 6-inches beyond the ends of the unit. Beam section shall be W10x15 for horizontal units and W6x15.5 for vertical units. Refer to the detail on the drawings. Duct connections to each unit shall be made with fabric necks as specified in Par. 15B-17.18.

NOTE: A unit indicated to be mounted overhead shall be provided with vibration isolating supports as specified in Par. 15B-22.05 and shall be installed in accordance with the details shown on the drawings.

(g) Air Filter

Unit shall be equipped with an air filter so located within the unit that all air is filtered before it contacts the heating element or fan. Filter shall be readily accessible for removal from the unit. It shall be of the configuration indicated on the drawing. Filter media shall be 5/8-inch minimum thickness polyurethane having 20 pores per linear inch, or other approved washable material, contained in a permanent metal frame. Media shall be crimped within the frame to form a V-shaped section which shall have a thickness of not less than 1 3/4-inches in the direction of air flow. Furnish a complete spare set of filters for each unit.

(h) Makes

Blower unit made by Airtherm Manufacturing Co., Aladdin Heating Corp., American Air Filter Corp., Bohn Heat Transfer Division, Carrier Corp., McQuay Inc., Trane Co. or York Division of Borg-Warner is acceptable.



15B-15.13. Heating and Ventilating Blower Unit-(Cont.)

Each unit shall conform to the requirements of the drawings, specifications and space conditions. Submit performance data and complete shop drawings of unit for approval.

15B-15.14. Air Conditioning Multizone Units

- (a) Furnish and install in the locations shown on the drawings, air conditioning multizone units of the capacities and characteristics indicated. Each unit shall contain heating and cooling coils, blowers, filter, blower motor, zone dampers, V-belt drive with guard, casing, etc., all properly assembled and tested at the factory. Each unit shall have the number of discharge zones as indicated on the drawings. Units shall be connected with ductwork and piping as shown on the drawings and as specified.
- (b) Casing shall be constructed of steel on a steel frame. It shall have a galvanized or chemically cleaned and painted finish. Access panels shall be provided on the entering and leaving sides of the heating coil and cooling coil. Interior of unit shall be insulated with  $\frac{1}{2}$ -inch minimum thickness coated fiberglass. Zone dampers shall be of steel, gasketed on all edges, and shall pivot in nylon bushings. Damper linkage shall be provided.
- (c) One steam heating coil and one chilled water cooling coil shall be installed in each unit. Heating coil shall be of the steam distributing type and shall comply with the requirements of Par. 15B-15.17. Cooling coil shall be of the drainable type and shall be provided with tappings for venting and draining. Tubes shall be copper of 5/8-inch minimum diameter, expanded into aluminum plate fins.
- (d) Unit shall be provided with a fully insulated corrosion-protected drain pan, located beneath the cooling coil. It shall have a 3/4-inch minimum size drain connection to provide for disposal of the condensate to the drainage system.
- (e) Fans shall be centrifugal type with forward curved wheels and with V-belt drive and belt guard. Fan shall be statically and dynamically balanced. Extended lubrication tubing shall be provided for fan bearings located within the casing. Face velocity over cooling coil shall be limited to 600 feet per minute, unless otherwise indicated on the drawings. Belt drive and motor shall be as specified in Par. 15B-13(a) and (d), respectively.

15B-15.14. Air Conditioning Multizone Units-(Cont.)

- (f) Each multizone unit shall be mounted on vibration absorbing supports as specified in Par. 15B-22.03. Each absorbing support shall be secured to a bearing plate welded to the top flange of a W6x15.5 beam. Two beams shall be provided, one under each side along the length of the multizone unit and extending 6-inches beyond the ends of the unit. Refer to the detail on the drawings. Duct connections to each unit shall be made with fabric necks as specified in Par. 15B-17.18.
- (g) Each unit shall be provided with an air filter so located as to filter all air before it reaches the coil section of the unit. It shall be of the configuration indicated on the drawings. Filter media shall be 5/8-inch minimum thickness polyurethane having 20 pores per linear inch, or other approved washable material, contained in a permanent metal frame. Media shall be crimped within the frame to form a V-shaped section, which shall have a thickness of not less than 1 3/4-inches in the direction of air flow. Furnish a complete spare set of filters for each unit.
- (h) Air conditioning multizone units made by Airtherm Manufacturing Co., Aladdin Heating Corp., American Air Filter Corp., Bohn Heat Transfer Division, Carrier Corp., McQuay Inc., Trane Co. or York Division of Borg-Warner are acceptable. Each unit shall conform to the requirements of the drawings, specifications and space conditions. Submit performance data and complete shop drawings of unit for approval.

15B-15.15. Unit Heaters (Steam)

(a) General

Furnish and install horizontal and/or vertical throw unit heaters of types, capacities, speeds, etc. as indicated on the drawings. Each unit heater shall be complete with propeller fan, motor, steam heating coil, casing, etc. Unit heaters shall each be securely supported by overhead floor beams, or by auxiliary steel beams installed by the HVAC Contractor for this purpose. Unit heaters shall be installed at the height indicated on the drawings, without interference from lights.

(b) Heating Coils

The heating coil in each unit heater shall be constructed of copper tubes expanded into aluminum plate type fins. Units having two-row coils shall have the tube rows staggered to provide maximum heat output. Heating elements shall be tested with air at a minimum pressure of 300 psi under water.

15B-15.15. Unit Heaters (Steam) - (Cont.)

(c) Fan and Motor

Fan shall be propeller type with aluminum blades, well balanced to operate quietly at rated output. Fans for horizontal discharge shall each be equipped with a wire guard. Motors shall be single speed, designed for continuous operation, and shall have the characteristics tabulated on the drawing. Motor and fan assembly shall be so mounted as to prevent vibration transmission to the casing. Motor shall be equipped with a terminal base for conduit connection. Overload protection for unit heater motor will be provided in the starter furnished and installed by the Contractor for Electric Work.

(d) Casing

Casing shall be constructed of furniture steel and shall be given a phosphatizing treatment to increase the bonding of the paint and to arrest corrosion. Finish paint shall consist of baked enamel in an approved color.

1. Louvers: Each horizontal throw unit heater shall be equipped with adjustable double deflecting discharge louvers, capable of being locked in position after setting. Louvers shall be curved, and die-formed from heavy gauge steel.
2. Diffusers: Each vertical throw unit heater shall be equipped with the type of diffuser or vaned outlet indicated on the drawings.

(e) Controls

Each unit heater fan shall be controlled by a wall mounted low voltage thermostat, the equal of Honeywell's T6051A with metal guard, located where shown on the drawing. Each unit heater shall also be controlled by a reverse-acting limit controller, the equal of Penn Controls Inc. A19DAC, which shall be installed on the condensate return piping, immediately after the trap. The limit controller shall act to prevent the operation of the fan unless steam is being supplied to the coil of the unit. Both thermostatic controls shall be wired to operate on 24-volts. A.C. HVAC Contractor shall deliver controls and proper transformer to the Contractor for Electric Work, who will install them.

15B-15.15. Unit Heaters (Steam)-(Cont.)

(f) Approved Makes

Unit heaters shall be as manufactured by Airtherm Mfg. Co., American Air Filter Co., Dunham-Bush Inc., McQuay Inc. or Trane Co. Submit complete shop drawings for approval.

15B-15.16. Unit Heaters (Electric)

Provide and install an electric unit heater in each location shown on the drawings. Each unit heater shall consist of an electric heating element, fan, motor, controls, etc., factory assembled in a sheet steel casing. Casing shall receive a bonderized rust-preventive coating, and a finished coat of baked enamel. Controls shall consist of an automatic temperature controlling thermostat located at the air intake to the heating element, and a fan delay switch which will prevent the fan from starting until the heating element is warm. Thermostat shall be capable of field adjustment, and shall be set initially at 40°F. Each unit heater shall be suspended by a bracket secured to an overhead floor beam or to an auxiliary steel beam installed by the HVAC Contractor for this purpose. Electric unit heaters shall carry the UL label and shall be American Air Filter Co.'s, Emerson Electric Co.'s Chromalox, Singer Co.'s Electromode or other approved equal, operating on single phase, 208-volt service. Submit shop drawings for approval. Contractor for Electric Work will provide service wiring to each unit heater.

15B-15.17. Air Heating Coils

(a) General

Furnish and install air heating coils for the air supply systems, in the locations indicated on the drawings. Coils shall be designed for operation on low pressure steam. They shall each have the net face area, finned length of tubes and final rise in temperature as tabulated, and shall be connected with steam and return piping, all as shown on the drawings.

(b) Construction

1. Standard Coils

Standard coils shall be made with not less than 5/8-inch O.D. copper tubes of .028-inch minimum wall thickness, plate type or spiral wound aluminum fins, and headers of copper, cast iron or fabricated steel. Fins shall have integral stamped collars and shall be mechanically bonded to the tubes.

2. Steam Distributing Coils

Steam distributing (non-freeze) coils shall be made with 1-inch (minimum) O.D. condensing tubes, 5/8-inch (minimum) O.D. inner steam distributing tubes, plate type or spiral wound aluminum fins, and headers of copper, cast iron or fabricated steel. Condensing tubes shall be copper with a wall thickness of not less than .035-inches and the distributing tubes shall be copper with .028-inches minimum wall thickness. Each distributing tube shall be provided with a means of centering it within the condensing tube. The performance of each steam distributing coil shall be such that under all quantities of steam supply, from maximum capacity to ten percent of maximum capacity, the steam will be delivered over the entire length of the heating surface with a maximum variation in temperature rise not exceeding a six degree deviation from the average rise through the heating surface.

3. Casing

Each heating coil, including the headers, shall be contained in a No. 16-gauge (minimum) galvanized steel casing, which shall be flanged and provided with holes for attachment to ductwork. Coil shall be pitched within the casing toward the return end. Means shall be provided for expansion of the coil.

4. Supports

Heating coils supported from the floor shall be provided with a sufficient number of No. 14-gauge galvanized sheet steel formed legs, reinforced and bolted. Ceiling mounted heating coils shall be supported from overhead floor beams or from auxiliary steel beams provided by the HVAC Contractor for this purpose. Coils shall be supported independently of connecting ductwork. Refer to the Standard Details.

(c) Approved Makes

Heating coils manufactured by Aerofin Corp., Airtherm Mfg. Co., American Air Filter Corp., Bohn Heat Transfer Division, Carrier Corp., Dunham-Bush Inc., McQuay Inc., Trane Co. or York Division of Borg Warner conforming to the requirements of the specifications and the drawings will be accepted. Submit shop drawings for approval.

15B-15.18. Automatic Air Filters

(a) General

1. Furnish and install in the locations shown on the drawings, vertical automatic roll type air filters of the renewable media type with the sizes and capacities indicated on the drawings.
2. Except for media support brackets and the media, roll filters shall be completely factory assembled. The arrangement of the filter media rolls shall be such that either the rolls are fully enclosed, or the outside surface of the clean roll becomes the air entering side as the media passes through the air stream and this surface is wound facing inward on the dirty roll. The filter media shall be so supported and confined in side tracks, that there will not be any leakage of unfiltered air. All metal surfaces exposed to the air stream shall be of galvanized steel construction. Inlet and outlet ends of the casing shall be drilled to facilitate duct work connections. Each filter shall be provided with an identification plate, mounted in a location where it will be readily visible after installation. The plate shall show serial number, model number, and all other data necessary for ordering renewal media.
3. All internal wiring shall be factory installed and in accordance with the New York City Electric Code. Electric motor shall comply with the requirements of 15B-16 and shall be equipped with built-in thermal overload protection. A jogging switch shall be provided and wired into the control circuit. Field wiring shall consist of service wiring to terminals on the control panel, and wiring between the control panel and the media runout signal light. Contractor for Electric Work will provide service wiring to the control panel and will install and wire to the signal light at a location on the exterior of the casing. Signal light shall be furnished by the filter manufacturer.

(b) Filter Media

1. Filter media shall have the minimum qualifications of Class 2, as defined by the N.Y.C. Building Code and it shall be accepted by the Material and Equipment Acceptance (M.E.A.) Division of the N.Y.C. Building Department, or the N.Y.C. Board of Standards and Appeals.

15B-15.18. Automatic Air Filters-(Cont.)

2. The filtering media shall be of continuously bonded fiber glass material having a nominal thickness of 2-inches, which when clean shall not compress more than  $\frac{1}{2}$ -inch when subjected to air at 500 feet per minute velocity. Each roll shall contain not less than 65 running feet of filter media. The media, when tested in accordance with National Bureau of Standards type dynamic test at a rated velocity of 500 feet per minute, shall have an average efficiency of not less than 75% and shall have received not less than 200-grams of dust per square foot of media. The operation and maintenance requirements of this filter shall be such as not to require water or sewer connections, or any type of adhesive reservoir.

(c) Operation

1. The roll of clean media shall be installed at top of filter casing, and the filtering material shall be automatically fed down the face of the filter and rerolled on a disposable spool at the bottom after it has accumulated its dirt load. A device shall be provided to insure compact rewinding of the dirt loaded media.
2. The frequency with which the filter media moves and the distance it travels shall be controlled by an automatic timer, interlocked with the fan motor starter, which shall move the filter media intermittently and shall maintain a substantially constant operating resistance. The media shall move only when the fan is in operation. The timer control shall be capable of full range field adjustment of media feed rate but shall be initially set so that the operating resistance under normal conditions is 0.45 inches w.g. Each filter section shall be provided with a runout switch, which shall be wired to the control panel. When the supply of clean media has been exhausted, the filter drive motor shall stop and the signal light shall be energized. Filter shall also be provided with a media overload pressure switch, so connected as to by-pass the timer and advance the media during periods when unusually heavy dust loads occur.
3. Provide and install an air filter gauge for measuring the resistance to air flow through the filters, one for each complete filter unit. The gauge shall be of the inclined tube differential type, of solid acrylic plastic construction with built-in level vial, equipped with two 3-way angle type valves for venting to atmosphere, and

15B-15.18. Automatic Air Filters-(Cont.)

shall have an adjustable scale of metal with clearly legible, engraved figures and graduations. The gauge shall be furnished with aluminum tubing, two static pressure tips, two toggle bolt mounting assemblies, all necessary fittings, an additional bottle of red gauge oil, and complete instructions. Gauge shall be Catalog No. 250-AF, reading to 1.0-inch water, in .02-inch divisions, as manufactured by the F.W. Dwyer Manufacturing Company, or other approved equal.

(d) Spare Filter Rolls

In addition to the roll of filter media required for the initial operation of each filter unit, two (2) additional rolls of media for each filter unit shall be furnished by this Contractor for use as spares. Filter media shall be the same make and type as regularly furnished by the unit manufacturer.

(e) Approved Makes

Automatic air filters shall be American Air Filter Co.'s Roll-O-Matic Model J, Cambridge Filter Corp.'s Auto-Roll, Continental Air Filters Co.'s Conomatic Type VA, or other approved equal conforming to the requirements noted herein. Submit complete shop drawings, etc., for approval.

15B-15.19. Sound Traps for Ductwork

(a) General

Where indicated on the drawings, provide and install in the ductwork packaged sound traps of proper models and sizes for the purpose of attenuating noise. Sound traps shall be as specified herein and shall conform with the requirements tabulated on the drawings.

(b) Construction

Outer casings of the sound traps shall be fabricated from No. 22-gauge, or heavier, galvanized sheet steel. Interior air passages shall be manufactured from No. 24-gauge, or heavier, galvanized sheet steel having 3/32-inch holes on 3/16-inch staggered centers. All parts shall be stiffened to eliminate audible vibration while being sufficiently pliant to absorb air vibrations. The spaces between the air passages shall be packed with inert, vermin-proof and sound absorbent acoustical material.



15B-15.19. Sound Traps for Ductwork-(Cont.)

(c) Performance

The attenuation values obtained by the sound traps shall be not less than those tabulated on the drawing. They shall be true attenuation values, and shall include only the true attenuation accomplished by the sound traps. These true attenuations shall not include any effects due to (1) end reflections, (2) room absorptions, (3) plenum absorption, (4) directivity, (5) beaming, (6) standing waves or (7) distance factors. The traps shall be tested by either the Insertion Loss Method or the End Difference Method of establish their ratings.

(d) Air Flow Pressure Drop

Air flow pressure drop values shall not exceed those indicated on the drawings. The air flow pressure drop performance shall be certified by the manufacturer to have been tested and rated in accordance with applicable portions of AMCA Bulletin 210, or with a method of air measurement approved by the Executive Director.

(e) Approved Makes

Sound traps shall be as manufactured by Industrial Acoustics Co., Inc., Koppers Co., Inc., Korfund Dynamics Corp., Silence, Inc., or other approved equal that conforms to the characteristics as outlined above and as tabulated on the drawings. Submit complete shop drawings for approval.

15B-15.20. V-Belt Drives

(a) Belt drives for fans and air handlers shall be of the V-belt type, with single or multiple belts, as indicated on the drawings. Sheave and belt sizes shall correspond with those shown. Each drive shall be complete with driving and driven sheaves, belts, keys, set screws, etc. Driving and driven sheaves shall be made by the same manufacturer.

(b) Sheaves shall be of the best quality gray cast-iron or steel, provided with grooves to fit the belt to be furnished and shall be bored to fit the shaft exactly. Sheaves shall be fastened by means of heavy steel keys and countersunk, cup-point set-screws. Split taper bushings or interchangeable concentric bushings also will be accepted. The diameters of the sheaves shall be as shown on the drawings. Provide a companion sheave on the fan shaft with groove spacing matching that of the variable pitch sheave.

15B-15.20. V-Belt Drives-(Cont.)

(c) Variable Pitch Sheaves

Motors for all belt driven fans and air handlers shall be equipped with variable pitch type sheaves. Pitch diameter for each pulley shall be adjustable within the limitations of the dimensions shown on the drawings. The pitch diameter variation of all flanges shall be made by means of a single adjusting device. Variable pitch sheaves furnished shall be such that specified capacities will be delivered with sheaves at approximately mid-position. Variable pitch sheaves shall be stationary control type, manufactured by Browning Mfg. Co., Dodge Mfg. Co., T.B. Wood's Sons Co., or other approved equal.

(d) Belting

Belts shall be strong cord-reinforced rubber of the highest quality, or other approved equal, designed to fit the sheave grooves properly. The manufacturer's name and brand of belt or trademark shall be molded or indelibly stamped on each belt for easy identification. When required, samples of belting shall be submitted for approval. Belts shall be Browning Mfg. Co.'s "Super-Gripbelt", Dayco Corp. "Super-Thorobred", Gates Rubber Co.'s "Super Vulco", or UniRoyal Inc. "U.S. Royal".

(e) Shop Drawings

Submit for approval detailed shop drawings of each drive, before drives are assembled. The drawings shall indicate the following data:

1. Name of manufacturer.
2. Manufacturer's catalog number of drive.
3. Horsepower of drive.
4. Number and size of belts.
5. Diameter and type of driving pulley.
6. Diameter and type of driven pulley.
7. Distance between centers.

SECTION 15B-16  
ELECTRIC MOTORS

15B-16.00. Motors

(a) General

Furnish and install all electric motors of sizes, speeds, current characteristics, etc, as shown on the drawings and in accordance with the following specifications.

(b) Standards

1. All motors shall conform to latest editions of the Standards of the National Electrical Manufacturers Association and the American Standards for Rotating Machinery. Unless otherwise specified or permitted, motors shall be designed for continuous duty to operate on 3-phase, 60-cycle, 208-volt A.C. Standard 230-volt motors will not be accepted. Single phase motors shall be self-starting of the capacitor type wherever practicable. Split phase motors will not be approved.
2. Motors in general, unless otherwise specified, shall be of the squirrel cage induction type with cast iron frames to withstand full voltage starting and shall meet NEMA locked rotor current standards for constant, multi-speed or variable speed type, to suit the particular conditions. Motors for reversing operation shall be especially rugged for this service. Motors shall be of proper starting and running torque and have sufficient horsepower to avoid injurious overheating for the respective functions they are to perform. In general, motors of NEMA design "B" shall be furnished for normal torque, low starting current, low slip applications; motors of NEMA design "C" shall be furnished for high starting torque, low starting current applications. Special applications may require motors of other designs so that equipment will not be subject to undue stress or damage.
3. All motors shall have a 1.15 Service Factor Configuration and shall be furnished only with copper stator windings and copper wiring from the stator windings to the connection outlet box. Aluminum or copper clad windings or wiring are not acceptable. All motors shall have a combined efficiency of 85% under full load conditions and shall reflect a power factor of at least 0.85 into the electrical service lines

under full load conditions. All devices (capacitors, etc.) needed to correct the power factor shall be furnished and installed as part of the motor unit and wired directly to the motor within the motor enclosure.

4. Nameplate data on the motor shall indicate the electrical data of the motor/capacitor combination and the motor manufacturer shall be responsible for the assignment of overload (heater) element settings for the motor controller design. Other forms of power factor correction, other than by capacitors, will be considered by the Board of Education for approval after submission by the Contractor.
5. Motor speeds shall be as stated on the drawings. Motors shall be selected with a view to quiet operation and, where practicable, shall have resilient mountings. Each motor shall be equipped with a name plate giving full information as to phase, voltage, frequency, horsepower, speed, duty, temperature rise and type of enclosure. Voltage listed on the nameplate shall be either 120, 208, or 465 as required by the electrical distribution system.
6. Where drawings or specifications indicate motor horsepower for equipment, it shall be understood that these are minimum, and where requirements dictate a motor of larger rating, it shall be furnished as part of this contract. If this should occur, the HVAC Contractor shall inform the Contractor for Electric Work of the increase in motor horsepower, well in advance, so that adequate electric service will be provided.
7. Motor Enclosures and Temperature Rise.

Motors subject to excessive dust or abrasives shall be of the totally enclosed type. Motors subject to dripping oil or water shall be of the drip proof or otherwise enclosed type. Conditions constituting a hazard from an explosive standpoint shall require a motor of the explosion proof class. Temperature rise with Class "A" insulation shall be based on the following: Open frame: 40°C.; totally enclosed and fan-cooled: 55°C. Temperature rises shall conform to A.I.E.E. standards for continuous and/or short time rated motors.

15B-16.00. Motors-(Cont.)

8. Motors shall be equipped with suitable terminal boxes of ample size to make and house motor wire and conduit connections. Terminals or connectors shall be of an approved type. Boxes on enclosed type motors shall be of cast iron with threaded hubs and gaskets, and with non-corrosive cover screws.
9. Bearings, unless otherwise noted, shall be of the ball or roller type, designed for heavy duty service. They shall have a minimum B-10 life or 40,000 hours (average life of 200,000 hours). Each bearing, except sealed type having lifetime lubrication, shall be equipped with a pressure type lubrication fitting and with a drain plug.

(c) Tests

1. Before motors or equipment with motors are shipped to the site, motor data in accordance with the following schedule shall be submitted for approval. Five (5) copies are required.
  - A. Motors less than 20-horsepower: Data shall include manufacturer's name, motor type, frame designation, horsepower output, time rating, temperature rise, rpm at full load, frequency, number of phases, voltage, full load amperes, type of enclosure, type of bearings, type of lubrication.
  - B. Motors 20-horsepower to 100-horsepower: Include all test data indicated on standard motor data form of the Bureau of Gas and Electricity. Test data taken on previous exact duplicate motor will be accepted.
  - C. Motors over 100-horsepower: Furnish certified tests of the individual motor on standard forms as required by the Bureau of Gas and Electricity.
2. The Executive Director and the Director of the Bureau of Gas and Electricity reserve the right to make such tests as they deem necessary. In case such tests are unsatisfactory, motors may be rejected and the Contractor will be ordered either to modify, rebuild or replace equipment to meet specification. All motor test data shall be subject to the approval of the Executive Director and the Director of the Bureau of Gas and Electricity before motors are shipped from the factory.

15B-16.00. Motors-(Cont.)

3. The Contractor shall fill ALL items on Motor Data sheets, such as "Building", "Job No.", "Application", and any other information facilitating identification of motors with respective machines.

15B-16.01. Drip Pans

Each motor with oil lubricated bearings shall be provided with a drip pan, unless the motor is mounted on the same sub-base as the driven machine. Drip pan shall be made of No. 20-gauge galvanized sheet steel and shall be 1½-inches deep.

15B-16.02. Approved Makes

Motors shall be of highest grade manufactured by the following concerns: Allis-Chalmers Mfg. Co., Baldor Electric Co., Century Electric Co., Continental Electric Motors Co., General Dynamics Corp., General Electric Co., Gould Inc. Electric Motor Division, Howell Electric Motors Co., Imperial Electric Co., Lima Electric Motor Co., Louis Allis Co., Marathon Electric Manufacturing Co., Northwestern Electric Co., Peerless Electric Co., Reliance Electric & Engineering Co., Sterling Electric Motors Inc., Wagner Electric Corp., or Westinghouse Electric & Mfg. Co.

15B-16.03. Bureau of Gas and Electricity

- (a) The work shall be done in strict accordance with the rules of the Bureau of Gas and Electricity, and with Chapter 30, Title "B" of the Administrative Code of the City of New York (Electrical Code).

- (b) Certificates of Inspection

Application for certificates of inspection shall be submitted to the office of the Executive Director for review and approval before being forwarded to the Bureau of Gas and Electricity.

15B-16.04. Work by Others

Contractor for Electric Work will furnish and install all the starters for motors and also all the electric wiring to motors and starters, except where otherwise specified.

SECTION 15B-17  
DUCTWORK, BOILER BREECHING, ETC.

15B-17.00. General Requirements

(a) Scope

1. Furnish and install complete sheet metal ductwork for all ventilation systems shown on the drawings. Include the dampers, access doors, grilles, diffusers, ventilators, fan connections, supports, outside air intake chambers, tests, etc. all as indicated on the drawings and as specified.
2. Furnish and install boiler smoke breechings, connecting them to the flues and to the smoke outlets on the boilers as shown on the drawings and as specified.
3. Furnish and install belt guards, riser casings, etc., as indicated on the drawings and as hereinafter specified.

(b) Work by Others

1. The Contractor for General Construction will provide the masonry curbs with wood coping at roof to receive the ventilators, roof ventilators, and the roof type exhaust fans; openings in the chimney flues with angle frames or collars to receive the smoke breechings and the cleanout doors near the bottom of the masonry flues, setting of access doors in masonry and plaster walls, and setting of frames for grilles, unless otherwise shown on the drawings or specified.
2. The Contractor for Plumbing and Drainage will provide drains and will also furnish and install the warming pantry hood, to which this Contractor shall connect the exhaust duct, unless otherwise shown on the drawings or specified.

15B-17.01. Methods of Installation

The sizes and runs of ducts, the sizes and locations of grilles, etc., shall be as shown on the drawings. This Contractor is directed to refer to the drawings and specification for General Construction concerning the character of construction and finish in the different parts of the building and shall examine them carefully before installing any work. Care shall be exercised so as not to run ducts in the spaces allocated to pipes or electric conduits. Ducts shall be run at the elevations

15B-17.01. Methods of Installation-(Cont.)

indicated on the drawings. Proper clearances shall be provided for the swing of doors, lighting fixtures, etc. Ducts shall be concealed where so indicated. Where the corner of an angle iron brace or joint member projects into a walking passage, the corner shall be mitered and shall be padded with  $\frac{1}{2}$ -inch minimum thickness flexible foamed plastic material to minimize the possibility of injury to personnel.

15B-17.02. General Construction of Ducts

(a) Ducts shall be constructed of the gauges specified and shall be made of galvanized steel, excepting where the use of other materials is specified and/or shown on the drawings. Angles used in connection with the fabrication of galvanized steel duct work shall be galvanized steel. Ducts shall be assembled in accordance with the Standard Details. They shall be installed parallel to or at right angles to walls and partitions, parallel to ceilings, level and plumb, unless shown otherwise. They shall be formed and joined in such a manner as to be practically air tight. Ducts shall be stiffened (and where required, braced from walls, ceilings, etc.) so as to prevent sagging and to eliminate vibration. Hangers shall be provided as specified.

(b) Seams and Joints

Duct seams and joints shall be made in accordance with the Standard Details. Certain ducts, where indicated on the drawings, shall have their transverse joints sealed with tape to make the joints airtight. Tape shall be  $1\frac{1}{2}$ -inch wide "Weatherban" synthetic rubber sealant type 1202-T, manufactured by 3M Co., or other approved equal.

(c) Rivets, Screws, Etc.

All rivets, screws, bolts, etc., shall be tinned, cadmium plated or approved rust resistant. Bolts shall be button-head stove bolts,  $1/4$  x  $3/4$ -inch minimum size.

(d) Braces

Ducts and flues having either dimension 18-inches or more shall be braced in the center of lengths exceeding 7-feet with steel angle braces riveted or welded to the ducts. Braces shall be the same size as the angles shown for joints.



15B-17.03. Bends

Where the run of a duct changes direction or where branches are taken from a duct, bends shall have a minimum throat radius of not less than three-fourths of the width or depth of duct, depending upon whether the bend is in a horizontal or vertical plane, or not less than three-fourths of the diameter of a circular duct. Where this minimum throat radius cannot be maintained, square elbows with directional vanes shall be used. Directional vanes shall be constructed and installed in accordance with the details on the drawings.

Note: The requirements of this paragraph shall not apply to the final duct connection to grilles or registers unless called for on the drawings.

15B-17.04. Changes in Shapes

Changes in shape of ducts to suit conditions shall be made as shown on the drawings. The original cross-sectional area shall not be diminished in making a change in shape.

15B-17.05. Galvanized Sheet Steel

(a) General

All ducts, etc., except otherwise specified or shown on the drawings, shall be made of first class commercial quality, galvanized sheet steel, free from blisters, flux and uncoated spots. Sheets shall have a Class D or Class E zinc coating as defined in A.S.T.M. Designation A 93.

(b) Any rust spots that may develop along seams or at joints shall be painted with one coat of zinc chromate or red oxide paint.

(c) Furnish and install a neoprene gasket, ¼-inch thick, full width of flange, wherever a galvanized duct connects with an aluminum O.A.I. collar.

15B-17.06. Gauge of Metal

Galvanized steel sheets for ducts, etc., shall be in accordance with the following table:

up to 30-inches	(either dimension)	No. 24-gauge
30-inches to 54-inches	( " " )	No. 22-gauge
54-inches to 72-inches	( " " )	No. 20-gauge
72-inches and over	( " " )	No. 18-gauge
Warming Pantry hood exhaust duct		No. 16-gauge
Dampers		No. 16-gauge

Note: Gauges of metal for ducts which connect to the Warming Pantry hood exhaust duct shall be as regularly specified.

15B-17.07. Identification

Where the outside air intake for a supply fan system is isolated from the fan it serves, the connecting duct shall be identified at the intake. Identification shall consist of a 1/8-inch thick laminated plastic plate, with 1/2-inch white core letters, designating the system it supplies. Plate shall be secured to the wall adjacent to the intake.

15B-17.08. Openings in Walls and Floors

(a) In Walls

In general, the Contractor for General Construction will form openings in walls for the passage of ducts. The Contractor for HVAC shall furnish to the Contractor for General Construction, the exact location and size (including clearances) of each opening required. HVAC Contractor shall provide any additional openings which may be required for his work. The openings shall be cut, framed and provided with sufficiently strong lintels. The jambs shall be built square and plumb, and shall be finished to match the adjoining work.

(b) In Floors

1. When the floor and/or roof slab construction for the project is the composite metal deck type, consisting of corrugated sheet steel and reinforced concrete, the following directions apply: Any opening, which is not framed by structural steel beams on all sides (refer to the structural steel drawings), and which is required in steel decking for the installation of HVAC work shall be cut by the HVAC Contractor. Openings shall be made by installing the proper size form (prior to the pouring of concrete by others), and cutting the metal deck when the flues are to be installed. Holes greater than 6-inches but less than 30-inches in any dimension will be reinforced by the Contractor for General Construction. Holes 6-inches or less in dimension need not be reinforced.
2. When the floor and/or roof slab construction for the project is of conventional reinforced poured concrete, the following directions apply: The G.C. Contractor will form openings in the slabs for the passage of ducts. HVAC Contractor shall furnish to the G.C. Contractor the exact location and size (including clearances) of each opening required.

15B-17.08. Openings in Walls and Floors-(Cont.)

(c) Safing

HVAC Contractor shall safe off all unused portions of openings through floor slabs provided for the passage of flues, after the ductwork is installed. Safing shall consist of No. 18-gauge galvanized sheet steel, supported by 1½"x1½"x1/8" (minimum size) galvanized steel angle bars. The horizontal leg of each angle shall overlap and rest on the edge of the floor slab bounding the opening. It shall be secured to the slab. The vertical (downward) leg of the angle shall be cropped 3-inches at the ends for this purpose. The sheet steel shall rest on and be secured to the angle bars by means of screws. The Contractor for General Construction will apply a mortar layer over the safing.

15B-17.09. Access Doors

(a) In Ducts

Access doors of sizes indicated shall be provided in ducts at locations shown on the drawings for cleanouts, access to fire dampers, heating coils, etc. They shall be constructed of galvanized sheet steel, shall be of the gauges specified and shall be hinged type, unless otherwise shown on the drawings, or where conditions are such that hinged type doors cannot be accommodated. Hinged doors shall open outward, and shall be practically air-tight when closed. Access doors shall not project into ducts so as to reduce the area of ducts. Refer to Standard Details. Air Balance Inc. "Fire/Seal" access door Model FSA-100 with neoprene gasket also is acceptable. Door size indicated on drawing shall mean clear opening size.

(b) In Walls and Ceilings

1. This Contractor shall furnish access doors for access to valves, dampers, and equipment which are concealed in walls, furring and hung ceilings, as shown on the drawings. Access doors (14"x14" minimum size) shall also be furnished for access to air piping installed in hung ceilings, as specified in Par. 15B-8.20(i). These access doors shall be delivered to the Contractor for General Construction, who will install the same. Delivery of the access doors shall be made so as not to cause delay in the work of the Contractor for General Construction. This Contractor shall inspect the installation of the access doors and shall immediately inform the Executive Director in writing, if they are not being located and installed to afford proper access to the equipment.

15B-17.09. Access Doors-(Cont.)

2. Access doors shall have one piece plain trim with hinged door and shall finish flush with the finish surfaces. The door openings shall be of sizes not less than those shown on the drawings. Doors shall be provided with concealed hinges, shall close flush against continuous stops and shall be provided with paracentric type locks. Doors in ceilings may have screwdriver operated locks. Doors in walls or in furring shall have key operated locks. Keys for all access door locks shall be interchangeable. Four (4) keys shall be delivered to the Custodian. Access doors and the frames shall be made of high grade sheet steel, not lighter than No. 16-gauge for sizes up to and including 16-inches, and doors for larger sizes shall be No. 14-gauge. Access doors shall be equipped with anchors for setting in plaster, furred ceilings, etc. They shall be primed at the factory, and the finish painting will be performed by the Contractor for General Construction. Access doors shall be manufactured by Karp Associates, Inc., or other approved equal, conforming to the requirements of the specifications. Submit sample for approval, if not already approved.

15B-17.10. Test Hole Fittings

Furnish and install a test hole fitting for making air readings, on both (opposite) sides of discharge duct from all supply and exhaust fans, at set dampers on supply branch ducts, and at other locations where shown on drawings for the proper adjusting and testing of the ventilating systems. No test hole fittings are required for roof type or other propeller type fans. Each fitting shall consist of an aluminum casting, or equal, similar in design to that shown on the Standard Detail. "Duro-Dyne" instrument test port, "Ventlock 699", or equal are suitable for this purpose.

15B-17.11. Dampers

Furnish and install all the manually operated dampers (set dampers, deflecting dampers and movable dampers) shown on the drawings. Dampers in galvanized sheet steel ductwork shall be made of galvanized sheet steel. Refer to the Standard Details. Dampers in non-ferrous ducts shall be made of the same materials as the ducts and shall have non-ferrous parts. Thickness of material, etc., for these dampers shall be the equivalent of those specified for steel dampers. Fire dampers and louver dampers are specified in Par. 15B-17.12 and 15B-19.10. Refer to Par. 15B-15.06(g) for self-acting louver dampers for roof type exhaust fans.

15B-17.12. Fire Dampers

Furnish and install galvanized steel fire dampers in the ductwork in the locations indicated on the drawings. They shall be installed in accordance with the details shown on the drawings. Fusible links shall operate at approximately 160°F. Each fire damper shall be approved by the N.Y.C. Board of Standards and Appeals and shall bear a label indicating this approval, as well as the pertinent B.S.&A. Calendar number. Fire dampers shall be Advanced Air Inc. Series 75, Air Balance Inc. "Fire Seal", Imperial Damper Co. No. VWNYS-1, Ruskin Mfg. Co. Model IBD, or other approval equal. Submit shop drawings for approval.

15B-17.13. Blanking of Duct Openings

Openings in ductwork shall be protected against the entry of dirt, plaster, etc. during building construction by means of sheet metal blanks, covering the openings. Blanks shall be removed just prior to the installation of grilles.

15B-17.14. Hangers and Supports

- (a) All ducts shall be run at the levels indicated on the drawings, as close to the ceiling as possible, excepting where pipes or electric conduits are indicated as passing above them. They shall be installed within the enclosing work (hung ceiling or furring) shown on the drawings and shall not interfere with its construction. Runout necks shall be brought out at the heights shown on the drawings. Horizontal ducts shall be supported on galvanized steel hangers. For ducts having a cross-sectional area of 4-square feet or less, the hangers shall be located near each duct joint and shall be spaced not more than 8-feet apart. For ducts having a cross-sectional area greater than 4-square feet, the hangers shall be located near each duct joint and duct brace, and shall be spaced not more than 4-feet apart. Refer to Standard Details. Where one duct is run below another duct of greater width, the lower duct shall be hung from the braces of the upper duct by means of strap hangers bolted to the braces of the upper duct. The braces of the upper duct shall be increased in thickness in such cases.
- (b) Copper ducts shall be supported from copper hangers, or from galvanized hangers insulated with a thick coat of black asphaltum paint.

15B-17.14. Hangers and Supports-(Cont.)

- (c) 1. When the floor and/or roof slab construction for the project is of conventional reinforced poured concrete type, the following directions apply: Overhead ductwork shall be supported by hangers secured to inserts installed by this Contractor before the floor slabs are poured by the Contractor for General Construction. Inserts shall be approved by the N.Y.C. Board of Standards and Appeals. Attachment of hangers to existing slabs of this type of construction shall be made with B.S.&A. approved self-drilling concrete anchors. They shall be the equal of Molly Co.'s "Parabolt", Phillips Co.'s "Red Head" or Rawlplug Co.'s "Saber Tooth".
2. When the floor and/or roof slab construction for the project is the composite metal deck type, consisting of corrugated sheet steel and reinforced concrete, the following directions apply: Overhead ductwork shall be supported by hangers secured to beam clamps or to steel deck inserts. Steel deck inserts shall be of a type that is supported by the concrete slab and not by the metal deck. They shall be approved by the N.Y.C. Board of Standards and Appeals and shall be the equal of Phillips Drill Co.'s "Red Head" Steel Deck Inserts. Submit shop drawings for approval.
- (d) Vertical ducts shall be supported at each floor level with steel angle braces extending around duct and with an end of an angle extending beyond duct and resting on the floor construction at each corner of the duct. Supporting angles shall be 1 x 1 x 1/8-inch for ducts up to 30-inches (in either dimension). 1½ x 1½ x 1/8-inch from 30 to 60-inches and 1½ x 1½ x 1/8-inch 60-inches and above.
- (e) The steel angle braces about the flues terminating in a louvered penthouse shall be coated with plastic roofing cement after installation, so as to make the opening through the roof slab around the flues water tight.

15B-17.16. Stainless Steel Ductwork

Where stainless steel ductwork is indicated on the drawings, it shall be fabricated from Type 304 (18/8) stainless steel sheets with standard mill finish. Rods, angles, and other structural shapes used in connection with stainless steel sheets shall be of stainless steel. Gauges of stainless steel sheets used for ductwork shall be the same as those specified for galvanized steel sheets in Par. 15B-15.06.

15B-17.17. Aluminum Ductwork

When aluminum ducts are indicated on the drawings, the construction of the aluminum ducts shall be similar to the construction of galvanized steel ducts as specified in this Section, except that the sheets shall be type 2S aluminum. Hangers and braces shall be of galvanized steel. Ducts whose larger dimension is 12-inches or less shall be fabricated from No. 24-gauge aluminum; from 13-inches through 30-inches shall be No. 22-gauge; from 31-inches through 54-inches shall be No. 20-gauge; from 55-inches through 84-inches shall be No. 18-gauge; over 84-inches shall be No. 16-gauge. Where an aluminum duct is to be joined to a galvanized steel duct, the end of the galvanized steel duct shall be coated with black asphaltum paint before it is connected to the aluminum duct.

Note: All joints and seams in Shower Room exhaust ductwork shall be made watertight by the use of a suitable sealant. Longitudinal seams shall not be located at bottom of duct.

15B-17.18. Fan Connections

- (a) Furnish and install an air-tight fabric neck at the inlet and at the outlet connections of all air handling units, supply fans and exhaust fans (except roof type exhaust fans specified in Par. 15B-15.05 and propeller type fans.)
- (b) Necks shall be not less than 3-inches nor more than 10-inches in width and both sides shall be secured in a crimped lock seam for the entire perimeter to galvanized sheet steel bands 3-inches in width. This assembly shall be securely fastened to ducts and to fans, and the joints shall be made air tight. Necks shall not be oiled or painted. Neck fabric shall be one of the following materials:
  1. Cotton duck, 10-ounces per square yard minimum weight, conforming to Federal Specifications CCC-C-428D (treated for fire, water, and mildew resistance.)
  2. Flameproof elastomeric coated glass fabric, weighing not less than 14-ounces per square yard, having a tensile strength of 200 psi (minimum) and having a heat resistance of up to 500°F. ("Thermafab", manufactured by Duro Dyne Corp., is an example of this material.)
  3. Close woven glass cloth, double neoprene coated, 28-ounces per square yard minimum weight.

15B-17.18. Fan Connections-(Cont.)

- (c) Where ambient air temperature exceeds 100°F. (kitchen exhaust, for example), use material No. 2 or No. 3. Where material is exposed to weather or corrosive fumes (acids, alkalies, garage or fume hood exhausts) use material No. 3.

15B-17.19. Roof Ventilators for Gravity Exhaust

- (a) Furnish and install roof ventilators for gravity exhaust, sized and located where shown on the drawings. Each roof ventilator shall be installed on the curb opening provided by the General Construction Contractor. Duct connection for the ventilator shall be extended to the top of the wood sill and flanged over. Ventilator base shall fit over the curb opening and shall be made airtight by the use of a heavy roofing felt gasket. The base shall be secured to the wood sill with stainless steel lag screws.
- (b) Roof ventilators up to 10-inches in diameter shall be made of No. 22-gauge (.025-inch) aluminum. Ventilators 12-inches to 18-inches diameter shall be No. 20-gauge (.032-inch) aluminum with aluminum rivets, angles, screens, etc. Screens shall be 3/4-inch mesh No. 18-gauge aluminum wire cloth.
- (c) Roof ventilators shall be the equal of G.C. Breidert Co.'s "Air-X-Hauster", Penn Ventilator Co.'s "Omega" or Triangle Engineering Co.'s "Mastervent" complying with the specifications. Submit shop drawings for approval.

15B-17.20. Louvered Penthouses

- (a) Furnish and install a louvered penthouse constructed of extruded aluminum on the roof at each location shown on the drawings. Penthouse shall be of the size indicated, and shall be designed to fit the rectangular outside air intake or exhaust opening through the roof curb.
- (b) The roof curb will be provided by the Contractor for General Construction and will, in general, consist of 4-inch thick reinforced concrete with wood sill at top. Penthouse base shall be equipped with an aluminum skirt which shall overlap the sill. The joint between the base and the sill shall be made tight by means of heavy roofing felt or other approved counter flashing material. Penthouse shall be secured to the inside of the wood sill and the curb through the vertical angle stiffeners by means of stainless steel screws. Underside of aluminum skirt shall be coated with black asphaltum paint before installation.



15B-17.20. Louvered Penthouses-(Cont.)

- (c) Penthouse shall consist of four storm proof louvered sides and solid pitched roof, framed and reinforced, and constructed entirely of aluminum. Penthouses for curbs whose longer side is 4-feet or less (inside dimension) shall be constructed with mitered corners heliarc welded and reinforced by 2" x 2" x ¼" inside corner angles. Larger size penthouses shall be constructed with corner posts 1/8" thick. Frames and blades shall be fabricated of extruded sections, 1/8" in thickness of 6063-T5 aluminum alloy. Blades shall be 4-inches in width and spaced on 4½-inch (maximum) centers. The lower portion of each blade shall overlap the upper portion of the blade beneath it a sufficient distance to prevent the entrance of snow or rain driven horizontally at the penthouse. The amount of this overlap is subject to approval by the Executive Director and shall be dimensioned on the shop drawings. Louver sections shall be reinforced vertically with 2" x 2" x ¼" angles from the base to the roof, spaced on a maximum of 4-feet centers. A bird screen of not less than No. 16-gauge expanded aluminum or No. 12-gauge, 3/4-inch mesh aluminum cloth fitted in a frame, shall be secured to the inside of each louver section. Roof shall be 1/8-inch 5005-H14 sheet aluminum suitably reinforced on 4-feet (maximum) centers and insulated with membrane undercoating or other approved means.
- (d) Louvered penthouse shall be as manufactured by Alpine Sheet Metal & Ventilating Co., Arrow Louver & Damper Co., Hugh Richards Associates, Inc. or other approved equal conforming with the drawings and specifications. Submit complete shop drawings for approval.

15B-17.21. Grilles, Frames, Etc.

- (a) General Requirements
1. Except as otherwise shown on the drawings or specified, all grilles required for HVAC work, together with frames to receive them, shall be furnished by the HVAC Contractor. Grilles shall be of the dimensions shown on the drawings which shall mean the inside frame dimensions and shall not include the border of the grille. The Executive Director reserves the right to require grilles to be of such dimensions that will conform with the architectural treatment of the building, providing that no change is made in the net grille area shown.

15B-17.21. Grilles, Frames, Etc.-(Cont.)

2. Type "A" frames for grilles shall be made in accordance with the Standard Details. The HVAC Contractor shall deliver the frames to the Contractor for General Construction for installation by him and shall make the delivery at the site in ample time to prevent delay in the building of partitions, ceilings, etc. by the General Construction Contractor. HVAC Contractor shall connect the ductwork and the grilles to the grille frames. Frames shall be given a prime paint coat at the shop.
3. Grilles for convector enclosures shall be as specified in Section 15B-12.
4. Grilles indicated on the drawings to be installed in pan type hung ceilings shall be fabricated of aluminum and shall be designed for installation without frames in that type of ceiling.

(b) Construction of Grilles

Unless otherwise indicated, grilles shall be solid steel bar type having straight bars without waves or sharp edges, evenly spaced. Ends of grille flanges (borders) shall be turned down, and a rubber gasket shall be cemented all around the back. Refer to the Standard Details for size, thickness and spacing of bars, size and thickness of flanges, method of fastening, etc. Grilles having details of construction differing from the Standard Details may be accepted, subject to prior approval by the Executive Director. Grilles shall be given a prime paint coat at the factory.

(c) Exhaust Grilles

1. Exhaust grilles shall be equipped with an opposed blade or multi-shutter volume control device of steel, with the blades linked to operate in unison. This device shall be attached to the back of the grille flange, and shall be adjustable for required air volumes by use of a screw driver, Allen wrench, (or other approved means) through the front face of the grille. Opening area through the blades in each case shall be not less than the opening area of the grille.

Note: Where the drawings indicate "F.O.V.", a framed opening with volume control shall be furnished and installed.

15B-17.21. Grilles, Frames, Etc.-(Cont.)

(d) Supply Grilles

1. The volume of air delivered through each supply grille shall be controlled as follows: Where the branch duct connection is more than 2-feet long, an opposed blade volume control shall be secured to the back of the grille flange. Where the branch duct connection is 2-feet long (or less), an air turning device shall be located at the branch duct connection, and an opposed blade volume control shall be secured to the back of the grille flange. Each opposed blade volume control shall have its blades linked so as to operate in unison. Volume control shall be adjustable for required air volumes by use of a screw driver, Allen wrench, (or other approved means) through the front face of the grille. Air turning device shall be Independent Register Co.'s "Airtrol", Krueger Manufacturing Co.'s Series VC8, Titus Manufacturing Corp. "Air Guide AG-25", Tuttle and Bailey's "Santrol", or other approved equal. Blades of air turning devices shall be installed horizontally for vertical ducts, and vertically for horizontal ducts.
2. Where fixed deflecting type grilles are shown on the drawings, they shall have the bars fixed at the factory for types of deflection indicated on the drawings.
3. Adjustable Deflecting Type Grilles

Where adjustable deflecting type grilles are shown on the drawings, they shall be constructed so that the bars can be adjusted to such positions as to produce the distribution of the air called for on the drawings. Where the drawings indicate a grille to be adjustable horizontally and vertically, the grille shall have a double core with the bars of each core adjustable. In lieu of the foregoing, a grille with 45° fixed deflecting bars arranged to direct the air equally in two opposite directions and having individually adjustable vanes located behind and perpendicular to the direction of the front bars may be accepted. Furnish 4 adjusting tools and deliver them to the Custodian.

(e) Fire Damper Grille

Where the drawings indicate a fire damper grille (F.D. Gr.) to be installed, Contractor shall supply a grille, an interlocking blade type fire damper and a volume control device, all assembled and installed as detailed on the drawing. Fire dampers shall be

15B-17.21. Grilles, Frames, Etc.-(Cont.)

Board of Standards and Appeals approved and shall be so labeled. Grille shall be as specified in (h). Volume control shall be as specified in (c) or (d).

Note: Where the drawings indicate "F.D.O." (Fire Damper Opening), a fire damper grille as specified herein, but without grille core, shall be furnished and installed.

(f) Grilles of Other Materials

When grilles of other materials are indicated on the drawings, they shall in all respects, be as specified hereinbefore, except that the material used shall be of the kind indicated on the drawings. Thickness of metal shall be not less than the thickness of steel. Aluminum grilles shall have satin anodized finish. Aluminum grilles shall have aluminum volume controls.

(g) Special Registers

When "special registers" are shown on the drawings, they each shall consist of a grille and a volume control attached to the grille. Suitable means shall be provided for operating the volume control from the room by means of a chain or a key operated device. Four keys shall be delivered to the Custodian.

(h) Approved Makes

The following make, number and type grilles may be approved, providing they meet the specified requirements:

1. Independent Register Co.:

- a. Supply: 311-OB, 321-OB
- b. Exhaust: 311-OB or HMV, 321-OB or HMV
- c. Special register: 311-OB CO or HMV CO, 321-OB CO or HMV CO

2. Titus Manufacturing Co.:

- a. Supply: SNYGL-3
- b. Exhaust: ENYGS-3
- c. Special register: ENYGL-3CO

3. Tuttle & Bailey:

- a. Supply: T-117 G
- b. Exhaust: T-117 G
- c. Special register: T-117 G CO

15B-17.21. Grilles, Frames, Etc.-(Cont.)

4. Krueger Manufacturing Co.:

- a. Supply SPL 41G OBD
- b. Exhaust: SPL 40G OBD
- c. Special register: SPL 40G OBD

(i) Shop Drawings

Detailed drawings of all types of grilles and accessories being furnished, and a schedule of their sizes, types and locations shall be approved by the Executive Director before grilles are shipped from the factory.

15B-17.22. Air Diffusers

- (a) Air diffusers shall be of the circular or rectangular type as indicated on the drawings and shall be of the size to deliver the cubic feet of air per minute required. Diffusers shall be made of heavy gauge aluminum or steel as specified herein: Where diffusers are to be installed in a room with an unpainted aluminum pan ceiling, the diffusers shall be aluminum with clear satin anodized finish. In all other cases, the diffusers shall be of steel with baked enamel finish in a color as selected. Adjustment spindles shall be made of heavy steel.
- (b) Each diffuser shall be securely fastened to its connecting neck by means of a minimum of 4 screws equally spaced around the collar. HVAC Contractor shall furnish proper size No. 14-gauge galvanized steel frames for the air diffusers to be installed in plaster hung ceilings and shall deliver them to the Contractor for General Construction, who will install them.
- (c) Each circular and rectangular diffuser shall be provided with equalizing deflector vanes and with a splitter damper for volume control. Splitter damper shall be operable from the face of the diffuser.
- (d) Each air diffuser installed in a Gymnasium or Playroom shall be equipped with a shallow dome-shaped guard constructed of No. 9-gauge cold rolled steel wire. Guard for circular diffusers shall be fabricated of concentric rings spaced on 3/4-inch centers with radial wire stiffeners spaced at 45° and electrically welded to the concentric rings. Guards for rectangular diffusers shall be constructed of same gauge wire and in a manner similar to that specified for circular guards, except that they shall be rectangular in shape. A 2-inch diameter

15B-17.22. Air Diffusers-(Cont.)

opening shall be provided in the center. Complete guard shall be electro-cadmium or zinc plated. Guard shall be secured to air diffuser with plated steel clamps and stainless steel machine screws and nuts.

- (e) Air diffusers manufactured by the Anemostat Corp., Krueger Mfg. Co., Titus Mfg. Co., Tuttle and Bailey or other approved equal, conforming to the requirements of the drawings and specifications will be accepted. Submit shop drawings of diffusers and guards for approval.

15B-17.23. Streamers

Furnish and install tell-tale streamers at all supply grilles and diffusers throughout the building. Streamers shall be 6-inches long x  $\frac{1}{2}$ -inch wide, made of dark brown ribbon and shall be installed at the height directed. Streamers shall be put in position while dampers are being adjusted.

15B-17.24. Testing and Balancing

- (a) The Contractor shall adjust the flow of air in the ducts by regulating the dampers, or shutters behind grilles, etc., to provide the volume of air called for on the drawings to be discharged into and withdrawn from each room. In making such adjustments, the velocity of the air shall be measured with an anemometer or velometer at the openings of the supply ducts and exhaust ducts in each room throughout the building and also, as may be necessary in the main ducts of the supply and exhaust systems. Deflecting type grilles shall be adjusted to distribute the air in the manner indicated on drawings.
- (b) Air Delivery
1. Each supply fan and each exhaust fan shall be tested for required performance. The amount of air delivered or exhausted through each diffuser, grille or opening shall be measured under the following conditions:
    - A. In exterior rooms having exhaust ventilation only: open windows and close door.
    - B. In interior rooms having exhaust ventilation only: close door.
    - C. In rooms having supply and exhaust ventilation: close doors and windows and operate supply and exhaust fans.

15B-17.24. Testing and Balancing-(Cont.)

2. Where a ventilating system in an existing building is altered, dampers for the entire particular system shall be adjusted to obtain the air quantities at grilles indicated on the drawings.
- (c) The amount of air passing through each opening shall be not less than that marked on drawings for the respective outlets, nor shall it exceed such amount by more than ten percent (10%) in any case. Readings shall be taken in accordance with ASHRAE standards, and shall be of at least 30 seconds duration. Individual readings across the face of the grille shall not vary from the total required air quantity by more than ten per cent (10%). After damper settings have been approved by the Executive Director, the Contractor shall mark the positions of dampers with painted lines as directed.
  - (d) The operation of electric motors as may be required for the proper adjustment of duct dampers, etc., and the conduct of the above tests, will be permitted without charge to this Contractor for electricity consumed during such operation, provided, however, that this testing and adjustment is carried on during such times as specified in Paragraph 15B-1.40.
  - (e) Tests shall be conducted in accordance with the requirements of the N.Y.C. Building Code regarding Controlled Inspection of ventilation systems. Furnish to the Executive Director four (4) copies of an air reading schedule, signed by the person performing the tests, showing the quantities of air passing through diffusers, grilles and main supply and exhaust ducts. Schedule shall list each room or space, size of grilles and diffusers therein, design cfm and actual cfm measured, averaged velocity through each terminal, and design and actual cfm of each air moving device. Schedule shall also indicate the actual static pressure of each system, rated and actual amperage of each fan motor, and the rated and actual speed of each fan.
  - (f) The Board of Education will prepare plans, submit them to the Building Department and obtain approval of the ventilating systems' design. The Contractor's materials and work shall comply with all requirements of the Building Department.

15B-17.25. Riser Casings

Unless otherwise indicated on the drawings, all exposed risers, including the drop risers, shall be enclosed in casings extending from floor to a height of 7'-6" above floor. Riser casings shall be installed after the pipe insulation work is completed, inspected and approved. Casings shall be made of No. 24-gauge galvanized sheet steel, with the upper end wired with 1/8-inch half hard wire. Each casing shall be fastened to the wall at the upper end with a metal band and round head screws. Seams shall be located at the rear of the casing.

15B-17.26. Casings for Pipe at or Near Floors

Where pipes at or near floors are indicated on the drawings to be encased, pipes shall be supported, insulated, and the whole then enclosed in a casing of No. 20-gauge galvanized sheet steel. In existing buildings where run-outs are exposed at or near floors, the pipes shall be enclosed in casing as specified above. Valves and traps shall not be encased.

15B-17.27. Belt Guards

Provide and install removable belt drive guards for protection of personnel. Guard shall consist of combination sheet steel and expanded metal which totally encloses the V-belts and sheaves. The front shall be of expanded metal and shall have a tachometer opening, with cap plug, located at the fan sheave. Back of guard shall be of solid sheet steel of appropriate gauge, holed to accommodate fan and motor shafts.

15B-17.28. Heat and Smoke Detecting Devices

- (a) HVAC Contractor shall install heat detecting devices and smoke detecting devices in the ductwork at various locations, as indicated on the drawings. Provide a 12" x 12" access door in the duct near each detector. These detecting devices will be furnished by the Contractor for Electric Work, who will provide all wiring connections. HVAC Contractor shall operate the fans of the ventilating systems concerned, for the purpose of testing the heat and smoke detectors when so requested by the Contractor for Electric Work.
- (b) HVAC Contractor shall inform the Contractor for Electric Work of the proper temperature setting required for each heat detector. This temperature shall be approximately 40°F. (but not more than 50°F.) higher than the operating temperature of the system in which the heat detector is located.



15B-17.29. Boiler Smoke Breeching

(a) General

1. Furnish and install smoke breeching as shown on the drawings, extending from the boilers' smoke outlets to the chimney. Breeching shall be of the configuration and dimensions indicated.
2. Should conditions at the site necessitate a change in the arrangement of the breeching from that shown on the working drawings, Contractor shall submit for approval a detailed drawing (to scale) of the proposed change. This drawing shall also indicate the relationship of the breeching to piping, lights, etc. In such a case, Contractor shall not begin to fabricate the breeching until the Contractor's drawing has been approved by the Executive Director.

(b) Construction

1. Boiler smoke breeching shall be constructed of not lighter than No. 12-gauge black steel sheets with welded seams. Breeching shall be fabricated in sections, with  $1\frac{1}{2}$ "x $1\frac{1}{2}$ "x $\frac{3}{16}$ " steel angles at the ends of each section (for the purpose of bolting the sections together) and with  $1\frac{1}{2}$ "x $1\frac{1}{2}$ "x $\frac{1}{4}$ " steel angle braces in the center of sections which exceed 5-feet in length. Angles shall be riveted or welded to the steel sheets. Bolts and rivets shall be located on 6-inch maximum centers. Provision shall be made for expansion and contraction of breeching at the chimney opening. Fabrication and assembly of breeching shall be gas-tight.
2. Clean-out doors shown in the boiler breeching shall be not lighter than No. 12-gauge black steel. Doors shall have steel or cast iron frames and shall be fitted with hinges and catches.
3. Breeching shall be supported from overhead beams in the manner indicated on the Standard Details. Stiffening angles at supports shall be  $2\frac{1}{2}$ "x $2\frac{1}{2}$ "x $\frac{1}{4}$ " steel, riveted or welded to breeching. Supporting hangers shall be  $\frac{3}{4}$ -inch minimum diameter steel rods and shall be spaced not more than 8-feet apart. Where, because of the location of the breeching relative to overhead beams, auxiliary steel beams are required for the support of the breeching, such auxiliary steel beams shall be furnished and installed by this Contractor.

15B-17.29. Boiler Smoke Breeching-(Cont.)

4. Furnish and install 1"x1"x1/8" steel angles on 3-foot centers welded to the bottom surface of the breeching, parallel to the section ends, to support the wire lath which is part of the breeching insulation system. The projecting leg of each such angle shall have 1/8-inch diameter holes punched or drilled on 8-inch maximum centers.
5. Provide test openings and means of closing same in each boiler breeching, as required by the Department of Air Resources' "Engineering Criteria for Oil Burning Equipment". Provide a 3-inch high steel collar to serve as an insulation stop around each test opening. Area enclosed by collar shall be 4 x 4-inches. Where multiple test openings occur close together, a single collar shall be provided, which shall be located 2-inches from the openings, on each side. Collar shall be not lighter than No. 16-gauge and shall be welded to the breeching.

(c) Expansion Joints in Smoke Breeching

Provide expansion joints (when shown) in the smoke breeching at locations indicated on the drawings. These expansion joints shall be in accordance with the Standard Details. Packing shall be made of asbestos free material, the equal of Carborundum Co.'s "Fiberfrax Square Braid".

(d) Anchor

Smoke breeching shall be anchored (when shown) at location indicated with two 2" x 2" x 1/4" structural steel angles fastened from each side to an overhead beam with expansion bolts, etc.

(e) Draft Sequence Damper

Each boiler breeching shall have an opposed blade louver type damper installed in the location indicated on the drawings. Damper blades shall be made of not lighter than No. 12-gauge black sheet steel, shall be well balanced, and shall be close fitting for minimum air leakage. Blade stops shall be provided at top and bottom of damper housing, which shall be formed from not lighter than No. 10-gauge black sheet steel. Damper axles shall be of steel, shall be not less than 1/2-inch in diameter, and shall be supported on lubricated and sealed ball bearings mounted on the outside of the damper housing.

15B-17.29. Boiler Smoke Breeching-(Cont.)

Bearings shall be separated from the housing by means of 1/8-inch thick asbestos-free heat insulating pads. Linkage bars shall be not lighter than 1½ x ¼-inch black steel. The entire damper assembly shall be given a shop coat of high temperature aluminum paint. Submit shop drawings for approval. See Par. 15B-7.15 for damper actuator unit.

SECTION 15B-18  
SPRINKLER WORK

15B-18.00. General

- (a) Furnish and install in certain spaces of the building, where indicated on the drawings, a wet pipe closed circuit automatic sprinkler system, supplied from the water main of the building. It shall be complete in every detail and shall comply with the requirements of the N.Y.C. Building Code, and with the rules and regulations of the Building Department, the Board of Standards and Appeals, the Division of Fire Prevention of the Fire Department and all other public authorities having jurisdiction.
- (b) This Contractor shall furnish and install all materials, parts, labor, etc. necessary to make a complete, properly working installation, and when shown on the drawings shall furnish all of the apparatus for a complete, electrically operated sprinkler alarm system. See Par. 15B-18.02(c) for work by others.

15B-18.01. Sprinkler Heads

- (a) Automatic sprinkler heads shall be of spray type and shall be installed at proper positions as shown on the drawings, or as required. Pendant and upright sprinkler heads shall have deflectors to distribute the water laterally and downward in a wide pattern, approximating a half sphere. Where the drawings indicate sprinkler heads to be installed in areas having hung ceilings, the sprinkler heads shall be of the flush or recessed type. Nipples and sleeves shall be used where pipes pass through walls. Sprinkler heads shall be ½-inch size, unless otherwise shown on drawings and shall be approved type 165° F. heads. Sprinkler piping, heads, etc., shall be installed so as to clear electric lighting fixtures.

(b) Sprinkler Kit

Furnish a sprinkler kit consisting of a steel cabinet, spare sprinkler heads and a special sprinkler wrench. Six (6) spare sprinkler heads shall be provided when fewer than 300 heads are installed. Twelve (12) spare heads shall be provided for sprinkler systems containing between 300 and 1200 heads. Kit shall be delivered to the Custodian.

15B-18.02. Sprinkler Alarm Valve, Waterflow Detector, Etc.

(a) Alarm Valve

When shown on the drawings, furnish and install in the supply lines, the alarm check valves indicated, which shall be Globe, Grimes, Grinnell Co., Reliable Automatic Sprinkler Co., Star Sprinkler Corp. or other approved equal and of the latest approved type. Alarm valves shall be complete with all necessary attachments required to give an approved alarm signal, closed circuit accessories and terminals ready for connection to the sprinkler alarm system, and shall be complete with pressure gauges, drain valves, etc. This Contractor shall submit shop drawings of alarm valves for approval by the Executive Director.

(b) Waterflow Detector

When shown on the drawings, furnish and install a paddle type sprinkler waterflow detector in the sprinkler supply piping in the location indicated. Detector shall be equipped with a pneumatic retard device to prevent false alarms due to water surges. Paddle type waterflow detector shall be N.Y.C. Board of Standards and Appeals approved, and shall be the equal of Acme Fire Alarm Co. Type 430 or Reliable Automatic Sprinkler Co. Model A.

(c) Work By Others

The sprinkler electric alarm equipment including the control panel, bells, wiring, etc., will be furnished and installed by the Contractor for Electric Work. This Contractor is required to examine the specifications and drawings for Electric Work for this building (which are on file in the Estimating Room of the Board of Education) for information regarding the apparatus or parts to be furnished by others. All equipment for the Sprinkler Alarm System which is not specifically called for to be furnished by others, shall be furnished by this Contractor.

15B-18.03. Sprinkler Drains

Furnish and install at the alarm valve, a valved drain connection, which shall be carried down to the floor to discharge into the nearest floor drain, unless otherwise shown on the drawings. Low points of sprinkler piping that cannot be drained through the alarm valve drain or when there is no alarm valve, shall also be provided with drains as may be shown on the drawings or as required.

15B-18.04. Sprinkler Pressure Gauges

Furnish and install approved type and make pressure gauges. Gauges shall be complete with non-ferrous metal rings, cocks, drains, etc.

15B-18.05. Fire Department Connections

- (a) When shown on the drawings, furnish and install flush type siamese connections, complete with necessary check valves, drips, sensible caps, etc. Check valves shall be iron body with bronze clappers and seats. Caps shall be of galvanized iron and shall be finished in green enamel. Provide and deliver to the Custodian two spare sensible caps for each siamese connections. Siamese fittings shall be of polished heavy cast brass or cast bronze with heavy cast brass or cast bronze plate. Plate shall be inscribed "AUTOMATIC SPRINKLER" and "PART SPRINKLERED". The latter inscription shall be either an integral part of the plate or on a separate name plate securely fastened to or above the siamese connection. Where sidewalk siamese connections are indicated on the drawings, the riser pipe shall be red brass.
- (b) Where a fence encloses a portion of the building containing a Fire Department connection, this Contractor shall furnish and secure to the fence directly opposite the siamese connection a steel sign containing the following wording: "F.D. Siamese Sprinkler Connection Located...Feet Behind Sign." Sign shall be finished in porcelain enamel with one-inch red letters on white background.

15B-18.06. Testing and Approval of Sprinkler System

- (a) All necessary permits for work in connection with the installation of the sprinkler system shall be obtained by this Contractor before commencing any of the sprinkler work. The Board of Education will prepare plans, submit plans and obtain approval of the sprinkler system.
- (b) This Contractor shall test the entire sprinkler installation, including sprinkler alarm system, in accordance with the requirements of the Building Code and shall give at least 2 days' advance notice in writing of tests and inspections to the Commissioner of Buildings and to the Executive Director. Tests shall be conducted in the presence of the Commissioner or his authorized representative, and in the presence of representatives of the Board of Education, Fire Department and any other public authority having jurisdiction. In lieu of the presence of the Commissioner or his authorized representative, the Commissioner may accept a signed statement of an architect or engineer, whose name is submitted with the advanced notification specified above, declaring that he has witnessed the tests and that the sprinkler system meets the requirements of the Building Code. If a representative of the Commissioner does not appear within 2 days after receipt of such signed statement by the Commissioner, the report shall be deemed to be accepted by the Commissioner. All tests shall be performed as part of this contract.

15B-18.06. Testing and Approval of Sprinkler System-(Cont.)

(c) Sprinkler system shall be subjected to a hydrostatic pressure test for a period of one hour at a pressure of at least 100 psig at the topmost sprinkler head, and at least 200 psig at the lowest cross connection to the siamese connections. The contractor shall furnish all instruments, tools and labor required to conduct the test. He shall make any alterations to the sprinkler system required to obtain approval by the public authorities having jurisdiction.

(d) Submit shop drawings of sprinkler heads, alarm valve, and waterflow detector for approval.

15B-18.07. Ladders

Furnish and install permanent heavy steel ladders to provide access to valves, in accordance with the code requirements. Ladders shall be of width and height required, shall be made of heavy steel bars and heavy rungs and shall be permanently fastened at location. Where the shut-off valve adjacent to the sprinkler alarm valve is located higher than 6-feet above the floor, a ladder shall be provided and installed where directed.

15B-18.08. Sprinkler Valve Tags

Each valve in the sprinkler system shall be tagged in accordance with the requirements of the N.Y.C. Building Code, and the Board of Standards and Appeals.

15B-18.09. Painting of Sprinkler Piping

Refer to Section 15B-21.

SECTION 15B-19  
TEMPERATURE CONTROL

15B-19.00. General Requirements

(a) Scope

Furnish and install, complete and in satisfactory operating condition, a two pipe system of temperature controls, etc., as shown on the drawings and as specified. Control system shall be of the pneumatic room type and shall include the louver dampers and damper controls for the fan systems, louver dampers for oil burner fresh air intakes, indoor and outdoor thermostats, control cabinets, etc., all as required to make a complete control system.

(b) Shop Drawings

Submit complete shop drawings for each temperature regulating system and for each item of equipment furnished as part of the temperature regulating systems.

- Note:
1. Attention is directed to Par. 15B-8.20 (j) regarding drawings of the air piping system.
  2. In addition to the four (4) sets of shop drawings required by Par. 15B-1.17, another set, labeled "Central Shops", shall also be submitted for approval.

(c) Installation

The installation of the temperature control system shall be made by the manufacturer of the equipment.

15B-19.01. Tests

(a) Pressure Test

All air lines, air line valves, etc., shall be subjected to oil of peppermint and air test of 30 psi and the lines shall be made tight at such pressure. This test shall be made in the presence of the Executive Director or his designated representative, and the Contractor shall notify the Executive Director in writing at least three days prior to such test. This test is applicable to new and altered work.



15B-19.01. Tests-(Cont.)

(b) Operational Test of Equipment

1. Upon completion of the compressed air piping system, a pressure of 30 psi shall be placed on the system and maintained for a period of 24-hours. After that time, a loss of not more than 5-pounds pressure will be allowed. Thermostats and pneumatic operators shall be excluded from the test. This test is applicable to new and altered work.
2. The Contractor shall test all thermostats, pneumatic valves, and damper operators to insure that adequate air pressure is available for proper operation. Correct functioning of damper operation shall be demonstrated. With steam on, the Contractor shall turn all room thermostats down to their lowest setting, and it shall be shown that the steam supply to the convectors and to the air heating coils has been shut off. The thermostats shall then be adjusted to their highest setting, and the convectors and air heating coils shall be rechecked to determine if the steam supply has been resumed. Thermostats controlling cooling equipment shall also be tested in an equivalent manner. All inoperative thermostats, pneumatic valves, and damper operators shall be repaired or replaced. During these tests, the Contractor shall instruct the Custodian in the operation and maintenance of the entire temperature control system. Refer to Par. 15B-1.45.
3. The calibration of all room thermostats which control direct radiation shall be checked at a time when the outdoor temperature is below 50°F. The set point of each thermostat shall be increased approximately 5°, and the room temperature shall equal the new thermostat setting, when measured by a test thermometer on the following day. Thermostats failing this test shall be recalibrated. At the conclusion of the testing, the specified set point for each thermostat shall be re-established.
4. Testing shall be done in the presence of the Custodian and a representative of the Executive Director.

15B-19.02. Guarantee and Inspection

- (a) In addition to the terms of the guarantee provided for in Section 15B-1, the Contractor shall guarantee the entire temperature control system for a total period of three years from the date of substantial completion of the heating and ventilating work. ("Substantial completion" shall be as defined in the Contract.) The guarantee shall include the repairs and adjustments to all components of the temperature control system. Repairs and adjustments shall be performed by mechanics employed by the temperature control manufacturer. The guarantee shall also include an annual inspection and servicing of the temperature control system, to be performed with a two-month period prior to the start of the heating season. The inspection and servicing shall be witnessed by the Custodian.
- (b) The Contractor shall submit with his application for payment at time of substantial completion, three (3) copies of the guarantee issued by the temperature control manufacturer.

15B-19.03. Approved Makes

Temperature control systems manufactured by Honeywell Inc., Johnson Controls Inc., MCC Powers Barber-Colman or Robertshaw Controls Co. conforming to the requirements of the drawings, specifications and job conditions will be approved.

15B-19.04. Air Compressors

- (a) Furnish and install in the location shown on the drawings a duplex type air compressor set complete with air tank, motors, V-belt drives, pressure switches, relief valve, pressure gauge, intake filter silencers, starters, electric alternator, etc. The two compressors shall be mounted on a A.S.M.E. National Board receiving tank. The entire unit shall be factory piped and wired. It shall be installed on a 4-inch high concrete base furnished by this Contractor.
- (b) Each air compressor shall be suitable for 80 psi working pressure and shall be capable of maintaining 15/19 psi air pressure (nominal) in the entire thermostatic system with the compressor in operation less than 1/3rd of the time that air is required, and at a speed of 450 rpm. Each compressor shall be single stage, one or two cylinders, air cooled, with drop forged steel crankshaft supported on both ends by means of Timken or other approved ball, roller or sleeve main bearings. Lubrication shall be of the constant level splash type, or of the pressure type, to assure adequate supply of oil to all working parts. Compressor shall be provided with oil-proof piston rings.

15B-19.04. Air Compressors--(Cont.)

- (c) Capacity of each compressor, size, speed and current characteristics of motor, together with the size of the air tank shall be as shown in the tabulated data on the drawings. Each compressor motor shall be drip-proof and shall conform to the requirements of Section 15B-16 of this specification. Motor base shall be provided with grooves for belt tightening purposes. V-belt drive shall be provided in accordance with manufacturer's standard practice. Provide totally enclosed, heavy gauge steel belt guard.
- (d) Each compressor motor shall be provided with a magnetic starter with disconnect and three thermal overload relays, the equal of Allen-Bradley No. 712. Pressure switches shall be Square D Co.'s Class 9013 Type ASG, or equal. Provide an electric alternator to alternate automatically the starting sequence of the compressor motors. Alternator shall be the equal of Furnas Class 47 NEMA 1. Electric controls shall be factory installed and wired in an enclosed steel cabinet, mounted on the unit. A complete wiring diagram shall be secured to the interior of the cabinet door.
- (e) Compressor unit shall be painted with a prime and finish coat of paint in accordance with the manufacturer's standard practice. Air tank shall be provided with a drain opening at the bottom, which shall be piped near the floor with a gate valve.
- (f) Contractor for Electric Work will furnish service wiring to the air compressor control cabinet.
- (g) Submit complete shop drawings of compressors, motors, drive, tank, starters, alternator, pressure switches, control cabinet, etc. for approval.
- (h) Air compressors shall be manufactured by Brunner Manufacturing Co., Curtis Pneumatic Machinery Co., Gardner-Denver Co., or Quincy Compressor Division of Colt Industries.

15B-19.05. Refrigerated Air Dryer

Furnish and install a refrigerated air dryer for the compressed air system for temperature regulation. The unit shall consist of a hermetically sealed, direct connected refrigerant compressor and motor unit, automatic drain valve, non-toxic refrigerant, automatic expansion valve, condenser, lubrication system, insulation, etc. contained in a cabinet. It shall be wall mounted. The air dryer shall be connected into the high pressure side of the compressed air line, with copper tubing, between the air tank and the pressure reducing station. Unit shall be

15B-19.05. Refrigerated Air Dryer-(Cont.)

non-cycling type, with sufficient capacity to provide the entire amount of dry air (based on 95°F. ambient temperature) required for normal temperature control system operation. Unit shall be Johnson Controls, Inc. No. A-421, or approved equal by Hankinson Corp., Honeywell, MCC Powers, or Quincy Compressor Co. Submit shop drawings.

15B-19.06. Filtering and Pressure Reducing Equipment

(a) Provide and install a compressed air pressure reducing station complete with moisture filter, oil filter, reducing valves, safety valves, isolating valves, gauges, brass piping and brass fittings. The use of type K copper tubing with brass or copper solder joint fittings is also acceptable for assembling this station. The reducing station shall be wall mounted adjacent to the air compressor. Equipment and piping shall be arranged to provide identical parallel paths for the compressed air to be discharged to the temperature control system at the reduced pressure required for the mode of operation.

(b) Moisture Filter

Furnish and install a moisture filtering unit in a valved by-pass around the refrigerated air dryer. (By-pass shall provide an alternate path for the air between the tank and the pressure reducing station in the event of malfunction of the refrigerated unit.) Filter shall have a polycarbonate bowl of at least ½ pint capacity, with bowl guard and with ½-inch pipe connections. Provide a 20 micron filter element with the unit, and six additional spare filter elements. Moisture filter shall be the equal of Monnier Brothers, Inc. "Whirl-A-Way" standard Air-line Filter. Submit shop drawings for approval.

(c) Oil Filter

Furnish and install a replaceable media cartridge type oil filter in the air piping between the refrigerated dryer and the pressure reducing station. Filter shall be do designed that the media can be replaced without removing the entire unit from the piping. A drain, with valve or petcock, shall be provided at the bottom of the filter assembly. Filter shall be installed in the piping with a valved by-pass arrangement.

15B-19.06. Filtering and Pressure Reducing Equipment-(Cont.)

(d) Reducing Valves

On the discharge side of the oil filter, provide two parallel branches, each branch having a minimum of three (3) ½-inch size pressure reducing valves. These valves shall reduce the air pressure, in stages, from 80 psi to 30 psi to 19 psi to 15 psi. A 3-way valve, having 19 psi and 15 psi inlets, controlled by a summer/winter switch, shall be provided to serve two-temperature control instruments. (19/15 psi are nominal pressures, which may differ, according to the control manufacturer's standard.) Each parallel branch shall be provided with gate valves arranged in by-pass fashion so that either branch may be used for the temperature control system.

(e) Air Gauges

Furnish and install a 2½-inch diameter air gauge before and after each pressure reducing valve specified in Par. (d), (8 air gauges required). Gauge before the primary reducing valves shall be 0-100-lbs. graduation. Movement for gauge shall be stainless steel gear mounted on socket independent of case. Case and ring shall be steel, with black baked enamel or approved equivalent finish. Gauges shall be mounted on the air piping. They shall be the approved equal of Acme Gauge & Instrument Co., Ashcroft Gauge of Dresser Industries, Honeywell, H.O. Trerice Co., Johnson, Marsh Instrument Co., U.S. Gauge Co., or Weksler Instrument Co.

(f) Safety Valves

Furnish and install an approved make A.S.M.E. standard bronze safety valve at the air tank and after each pressure reducing valve specified in Par. (d), (7 safety valves required). The safety valve at the air tank shall be ¾-inch set at 80-pounds per square inch and each safety valve after the primary reducing valve shall be ½-inch, set at 38-pounds per square inch. Safety valves after the other pressure reducing valves shall be ½-inch size, set approximately 5 psi higher than the setting of the reducing valve it follows. Safety valves shall be the approved equal of Crosby Valve & Gauge Co., Kunkle Valve Co. or J.E. Lonergan Co.

15B-19.07. Pneumatic Steam Valves

- (a) Pneumatic steam valves shall be provided in the steam connection to preheaters, heaters, booster heaters as well as in the steam connection to each direct and other indirect heat source where pneumatic thermostats are indicated on the drawings. Pneumatic valves controlling heating coils (except those in unit ventilators) shall be provided with identification tags, as specified in Par. 15B-9.08.

15B-19.07. Pneumatic Steam Valves-(Cont.)

- (b) Pneumatic valves shall be diaphragm operated and shall be of pattern and design to suit the space in which they are located. Diaphragm shall be molded of neoprene or other oil resistant synthetic rubber. It shall be of ample size to keep the valve shut steam tight against 10 psi steam pressure with 15-inches of vacuum in the system, and with 10 psi air pressure on the diaphragm. Tops, spiders, etc. of valves shall be metal, of substantial design, and able to withstand the strains incidental to the duty. Each pneumatic valve shall be provided with a throttling nut or similar device for regulating the flow of steam. Pneumatic steam valves shall be adjusted so that the valves will tightly close at the temperatures for which the thermostats are set.
- (c) Where an air heating coil is provided with two pneumatic steam valves, the pneumatic valves shall be so designed that they will operate in sequence. In cases where two different size valves are used to control an air heating coil, the valve operation shall be such that as the desired temperature is reached, the larger valve shall close first and the smaller valve shall close second. With falling temperature, the reverse valve action shall take place.
- (d) The air piping connections to valves shall be run concealed where practicable. Connections to valve tops shall be so made that the air piping cannot be stepped upon, broken by expansion, or otherwise damaged in service.

15B-19.08. Pneumatic Water Valves

Pneumatic water valves shall be brass, with either two-way body pattern for throttling or three-way body pattern for diverting, as indicated on the drawings. The pneumatic operator shall be as specified in Par. 15B-19.07 (b). Pneumatic water valves shall be installed where shown on the drawings. Except for those installed in unit ventilators and in fan coil units, pneumatic water valves shall be provided with identification tags, as specified in Par. 15B-9.08.

15B-19.09. Pneumatic Damper Operators

Pneumatic damper operators shall be of the piston type, diaphragm operated with spring return. Operators shall have ample power to perform the duties to which assigned. They shall be secured to the damper frame or to adjacent rigid surface for support to insure proper operation. Air piping connection to a damper operator shall be made only with looped copper tubing.

15B-19.10. Multiblade Dampers and Controls

(a) General Requirements

1. Multiblade dampers shown on the drawings in connection with outside air intake, exhaust air discharge, and air recirculation of the fan systems, as well as the boiler room outside air intake for the oil burners, shall be the product of the manufacturer of the temperature control equipment. Boiler room outside air intake dampers shall be divided into units corresponding with the number of oil burners, as indicated on the drawings.
2. Self-acting dampers used in the inlet to roof type exhaust fans shall be provided by the fan manufacturers as specified in Par. 15B-15.05(g).
3. Openings in walls for outside air intakes, together with stationary louvers and screens, will be provided by the Contractor for General Construction, unless otherwise shown on the drawings.

(b) Construction of Multiblade Dampers

1. Frames

Frames shall be of steel: 1/8-inch thick channel shape or ¼-inch thick flat bar. They shall be braced for rigid reinforcement. Frames shall be provided with bolt holes for mounting and with stationary stops on the four sides to prevent air leakage. Boiler room outside air intake damper frames shall be provided with drilled lugs on two sides in a lower corner, so that motor mounting bracket can be securely bolted to frame.

2. Blades

Damper blades shall be not wider than 10-inches, shall have formed interlocking edges, and shall have a ½-inch deep "V" pressed in the center to stiffen the blades. Blade axles, axle clamps and blade connecting lugs shall be of non-ferrous metal. Blades shall be linked firmly together so that all blades work in unison. The lower blade shall be provided with a linkage connection lug for motor operation of the damper. Open position of the blades shall be limited to 90°. Damper blades for fan systems shall be not lighter than No. 16-gauge galvanized sheet steel. Unless shown otherwise on the

15B-19.10. Multiblade Dampers and Controls-(Cont.)

drawing, damper blades for supply systems shall be of the opposed blade type, and those for exhaust systems and boiler room outside air intake shall be parallel type. Damper blades for Boiler Room outside air intake shall be not lighter than No. 14-gauge aluminum.

3. Bearings

Bearings on blade pivot points shall be fitted with stainless steel or non-ferrous metal sleeve (or ferrule type) pressed into damper frame. Bearings shall be accurately sized to fit blade axles, and shall provide smooth operation.

4. Linkage

Linkage or tie rod to interconnect blades shall be of non-ferrous metal and shall be secured to the blade lugs by means of cotter pins and washers.

(c) Painting

Damper frames shall be given one coat of black asphaltum paint over a prime coat of red oxide or zinc chromate. Galvanized steel damper blades shall be primed with galvanized iron primer and given one coat of black asphaltum paint. Painting shall be done at the shop.

(d) Control for Multiblade Dampers

Boiler Room outside air dampers shall be automatically operated by means of electric damper motors as specified in Paragraph 15B-7.22. Multiblade dampers in ductwork shall be controlled as indicated on the drawings and as follows:

1. Automatically (Air) Operated Dampers (A.A.D.)

Each multiblade damper indicated on the drawings as "A.A.D." shall be operated by means of an air motor and an electric solenoid air valve. Furnish and install in the air line to each air motor in a place convenient for operation, a direct-acting (air in main when energized) solenoid air valve and a three-way air valve or the approved combination of the two devices. The operation shall be such that when the fan motor is started, the damper will open; when the fan motor is stopped, the damper will close. It shall also be possible to by-pass the solenoid valve, by means of the three-way air valve, and to operate the damper manually. Solenoid air



15B-19.10. Multiblade Dampers and Controls-(Cont.)

valves shall be installed near the corresponding fan motor starters. Electric wiring connections between the solenoids and the motor starters will be made by the Contractor for Electric Work.

2. Manually (Air) Operated Dampers (M.A.D.)

Each multiblade damper indicated on the drawings as "M.A.D." shall be manually operated by means of an air motor and a three-way air valve. The valve shall be installed in the air line to the air motor in a place convenient for operation.

3. Manually Operated Dampers (M.L.D.)

Each multiblade damper indicated on the drawings as "M.L.D." shall be manually operated by means of chains, levers, or other manual devices as indicated.

15B-19.11. Room Thermostats

(a) General

1. Furnish and install a room thermostat in each location shown on the drawings. Thermostats shall be pneumatic, of the proportional action type, for two pipe operation. Room thermostats shall operate the pneumatic valves and/or damper operators to maintain design temperatures. Design temperature for heating shall be 70<sup>0</sup>F., except in shower, medical, dressing and locker rooms, where 80<sup>0</sup>F. temperature shall be maintained. Design temperature for cooling shall be 78<sup>0</sup>F. Setting adjustment shall be of tamper-proof design. Where one room thermostat controls five or more pneumatic valves and/or pneumatic operators, a relay shall be provided.

2. Each room thermostat in a space served by an air conditioning multizone unit shall be direct acting and shall be capable of maintaining separate cooling and heating temperatures without individual adjustment. Change of set point shall be accomplished by means of a "summer-winter" switch, remotely located.

(b) Thermostat Mountings

Each room thermostat shall be installed with its center approximately 7'-0" above the floor. Thermostat shall be mounted on a cast or stamped metal connector air head, which shall be installed flush with the plaster finish (or flush with the wall block where no plaster finish occurs). Air head shall be provided with tapped holes to secure thermostat body screws. Each thermostat mounted on an

15B-19.11. Room Thermostats-(Cont.)

exterior wall of the building shall be provided with an insulating block of wood or other approved material.

(c) Thermostat Covers

Covers for thermostats shall be substantially made of stamped or cast metal, with an approved finish. Each cover shall be suitably secured to the thermostat to prevent tampering. Special keys or wrenches required for cover removal shall be furnished to the Custodian. Each cover shall be provided with a narrow slot, behind which a glass thermometer shall be mounted and locked in position. Covers shall conform with the approved sample on file in the office of the Executive Director. Each cover for a thermostat which controls an air heating coil valve shall be provided with a nameplate to identify it with the proper coil.

(d) Thermostat Guards

Each thermostat installed in a playroom, cafeteria, corridor, gymnasium, locker room or shop shall be provided with a slotted metal guard or with a wire guard designed for heavy duty use, which shall be securely fastened in place.

(e) Approved Models

Single temperature room thermostats shall be Honeywell's TP910A or TP970, Johnson Controls, Inc. T-4002, MCC Powers "D" or "Powerstar" (Type TH180), or Robertshaw Controls Co. T-18. Barber-Colman Co. TK-1001.

15B-19.12. Duct Thermostats

Provide and install in the duct work, where shown on the drawings or where specified, remote bulb insertion type proportioning thermostats to control the air heating and/or cooling coil pneumatic valves and, where so indicated, the automatic air operated louver dampers.

15B-19.13. Freeze Protection Thermostat

Each preheater and the heating coil of each air handling unit shall be provided with an electric freeze protection thermostat located in the air discharge of the coil. The thermostat shall prevent the supply fan of that system from operating whenever the temperature of the air leaving the coil falls below 35°F. Wiring between the thermostat and the fan starter will be installed by the Contractor for Electric Work. When so indicated on the drawings, this thermostat shall be of the type that automatically resets itself as the air temperature increases, to allow the fan to start.

15B-19.14. Duct Thermometers

Furnish and install a duct thermometer adjacent to each duct thermostat. Thermometer shall be vapor, bi-metal or liquid actuated, dial or column type. Each thermometer shall have a scale graduated 30° to 180°F., and shall have a stem or bulb, not less than 8-inches long. Dial type shall be not less than 3½-inches in diameter and shall have a metal case and non-ferrous or stainless steel bezel. Column type shall have a non-ferrous metal case of 9-inch minimum length. Thermometers shall be adjustable type, so as to be easily readable when installed, from floor level. Thermometers shall be Honeywell Inc., Johnson Controls, Marshalltown Mfg. Barber-Colman Co. Moeller Instrument Co., MCC Powers, Robertshaw Controls, H.O. Trerice Co., Albert A. Weiss & Son, Inc., or Weksler Instrument Co. Duct thermometers and room thermometers (specified in Par. 15B-19.15) furnished under this contract are not subject to the terms of the guarantee, but shall be replaced or repaired by the Contractor only until the completion of the contract.

15B-19.15. Room Thermometers

Furnish and install a room thermometer in each location indicated on the drawings. Each thermometer shall have a scale at least 7-inches long, which shall have a range of approximately 20°-100°F. Thermometer shall have red reading fluid. Reading tube and scale shall be securely mounted on a finished wood back piece, which shall have a screw hole near the top and near the bottom. Thermometers shall be mounted to the wall with brass oval head screws and with its center approximately 5-feet above the floor. Room thermometers shall be as manufactured by Marshalltown Mfg. Co., Moeller Instrument Co., H.O. Trerice Co., or Weksler Instrument Co.

15B-19.16. Temperature Control Panel

When the drawings indicate that a temperature control panel is to be installed, the control manufacturer shall provide a wall mounted panel. The control items on the panel in each location shall be for the air supply systems located in that area. Equipment on each panel shall include an outdoor air temperature indicator, return air temperature indicator, mixed air temperature indicator, supply air temperature (in each zone of a multizone unit), relays, gauges, etc. Summer/winter switch for an air conditioning system shall be located on a temperature control panel, as directed.

15B-19.17. Control for Auditorium Heating and Ventilating System

(a) The auditorium supply fan, together with exhaust fan, air heating coils, dampers, etc. (see the drawings), shall function as follows:

(b) Start and Stop

Supply and exhaust fans shall each be started and stopped manually.

(c) Dampers (A.A.D.)

The two outdoor and and the two exhaust dampers shall be in closed position and the recirculation damper shall be in open position when the fans are not operating. When the supply fan starts, the minimum outdoor air damper and the minimum exhaust damper shall be actuated by a single electric pneumatic valve, which shall cause these dampers to open. Combined outdoor air and recirculated air shall be equal to 100%. The minimum position shall provide the per cent outdoor air and exhaust air indicated on the drawings. At the maximum position, the outdoor air dampers and the exhaust air dampers shall be fully open and the recirculation damper shall be fully closed.

(d) Operation

1. At all times, the preheat coil shall be controlled by a proportioning duct thermostat in the air leaving the coil that shall modulate the pneumatic steam valve or valves to maintain a constant air temperature of approximately 40°F.
2. The heater steam control valves, the variable outdoor air dampers, the variable exhaust dampers and the variable recirculation air damper shall be controlled in sequence to maintain air supply temperatures between a minimum of 60°F. and a maximum high temperature available.
3. A room thermostat, located where shown on the drawing, shall sense the temperature in the auditorium and shall affect the following sequence of operation through a sub-master to maintain the temperature of the auditorium at 72°F.: On a rising air temperature (above 72°F.), the steam control valves shall gradually close. If the temperature continues to rise, the variable dampers shall be automatically positioned to open gradually the outdoor air dampers and exhaust dampers and close the recirculation air damper. On a falling temperature, the reverse of this sequence shall take place.

15B-19.17. Control for Auditorium Heating and Ventilating System-(Cont.)

4. When the drawings indicate that a booster heater shall be installed as part of the indirect heating and ventilating system, its steam valve shall be controlled by another room thermostat.
- (e) The readjustment range and control points of all control instruments shall be adjustable to suit all normal temperature conditions.
- (f) When the supply fan is not running, all dampers shall return to their normal positions with outdoor air and exhaust dampers closed and recirculation air damper open.

15B-19.18. Control for Gymnasium Heating and Ventilating System

- (a) The Gymnasium supply fan, together with exhaust fan, air heating coils, dampers, etc. (see the drawings), shall function as follows:

- (b) Start and Stop

Supply and exhaust fans shall each be started and stopped manually.

- (c) Dampers (A.A.D.)

The outside air, exhaust air and recirculated air dampers shall be automatically (air) operated louver dampers (A.A.D.) The outside air and exhaust air dampers shall be in the closed position and the recirculated air damper shall be in the open position when the fans are not operating. When the fan starts, an electric-pneumatic switch shall pass air pressure to a manual gradual switch. The gradual switch shall be used to position the outside air, exhaust air and recirculated air dampers to provide any required mixture of outdoor and recirculated air, from 100% recirculated air to 100% outside air.

- (d) Operation

1. At all times, the preheat coil shall be controlled by a proportioning duct thermostat in the air leaving the coil that shall modulate the pneumatic steam valve or valves to maintain a constant air temperature of approximately 40°F.
2. The heater coil steam control valves shall be controlled to maintain air supply temperatures between a minimum of 60°F. and a maximum high temperature available. A return air duct thermostat shall sense the temperature in the Gymnasium and shall affect the following through the supply duct sub-master thermostat to maintain the temperature of the Gymnasium at 70°F.: On a rising room temperature, the thermostat shall

15B-19.18. Control for Gymnasium Heating and Ventilating System-(Cont.)

readjust the sub-master thermostat to a lower control point. On a falling temperature, the reverse shall take place. The sub-master thermostat in the supply duct shall modulate, in sequence, the heater coil pneumatic steam valves to maintain the required temperature.

3. When the drawings indicate that a booster heater shall be installed as part of the Gymnasium indirect heating and ventilating system, its steam valve shall be controlled by a room thermostat located in the Gymnasium.
  4. When the drawings indicate that a booster heater shall be installed as part of the indirect heating and ventilating system of the Gymnasium Locker Room, its steam valve shall be controlled by a duct thermostat located in the supply duct where shown on the drawing.
- (e) The readjustment range and control points of all control instruments shall be adjustable to suit all normal temperature conditions.
- (f) When the supply fan is not running, all dampers shall return to their normal positions with outdoor air and exhaust air dampers closed and recirculated air damper open.

15B-19.19. Cycle of Control for Unit Ventilator Associated with Direct Radiation

(a) General

The room thermostat shall control the pneumatic steam valves of the convectors and the operation of the unit ventilator to maintain the room at the desired temperature by modulating the steam valves to the convectors and to the unit heating element and by positioning the dampers of the unit.

(b) Operation

The control cycle shall operate so that:

1. During the warm-up period, no outdoor air shall be introduced, full steam shall be supplied to the convectors and to the heating element of the unit and the unit shall recirculate the room air.
2. As the room approaches the desired temperature (within 3 degrees) the minimum outdoor air indicated on drawings shall be introduced and the recirculation damper shall partly close. Whenever heating is required, except for warm-up periods, only the minimum outdoor air shall be introduced.

15B-19.19. Cycle of Control for Unit Ventilator Associated with Direct Radiation-(Cont.)

3. As the room temperature further increases, the pneumatic valves for the convectors and for the unit heating element shall modulate to maintain the desired temperature.
4. When the room is at the desired temperature, the discharge air temperature minimum of 60°F. shall be maintained by modulating the steam valve for the unit heating element. The pneumatic valves for the convectors shall continue to modulate to assist in the maintenance of the desired temperature.
5. The minimum temperature of the discharge air shall be 60°F. at all times during the time required for heating.
6. When heating is not required, 100% outside air shall be delivered by the unit.

15B-19.20. Cycle of Control for Unit Ventilator Not Associated With Direct Radiation

- (a) Each unit ventilator not associated with direct radiation shall be controlled by a room type pneumatic thermostat located where shown on the drawings to effect the following cycle of control:
  1. During the warm-up period, no outdoor air shall be introduced, full steam shall be supplied to the heating element of the unit, and the unit shall recirculate room air.
  2. As the room approaches the desired temperature (within 3 degrees), 100% outdoor air shall be introduced and the recirculation damper shall close.
  3. As the room temperature further increases, the pneumatic valve for the unit ventilator heating element shall modulate to maintain the desired temperature.
  4. When the room is at the desired temperature, the discharge air temperature minimum of 60°F. shall be maintained by modulating the steam valve for the unit ventilator heating element.
- (b) The minimum temperature of the discharge air shall be 60°F. at all times during the time required for heating. When heating is not required, 100% outside air shall be delivered by the unit.

15B-19.21. Cycle of Control for Heating/Cooling Unit Ventilator  
Associated with Direct Radiation

(a) General

The unit ventilator shall be started and stopped manually. The room thermostat shall control the pneumatic valves of the convectors and of the unit ventilator to maintain the room at the desired temperature. A solenoid air valve shall close the outdoor air damper whenever the unit ventilator blowers are not operating.

(b) Heating (summer-winter switch in "winter" position):

1. When the room temperature is below 70°F., the convector valves shall be fully open. The unit ventilator's outdoor air damper shall be closed, the recirculation air damper shall be open, and the heating coil valve shall be fully open.
2. As the room temperature approaches the thermostat setting (within 3 degrees), the convector valves shall modulate toward their closed position and the outdoor air damper shall open to admit the minimum amount of air required for ventilation. The heating coil valve shall modulate toward the closed position.
3. As the room temperature exceeds the thermostat setting, the heating coil valve shall close.
4. Further increase in room temperature shall cause the outdoor air damper to increase its opening gradually to the maximum position, at which point the recirculating damper shall be closed.
5. The minimum temperature of the discharge air shall be 60°F. at all times during the heating cycle.

(c) Cooling (summer-winter switch in "summer" position):

1. When the room temperature is above 76°F., the convector valves shall be fully closed, the outdoor air damper shall be fully closed, and the recirculation air damper shall be open. The face and bypass damper shall be open to the coil, and the unit ventilator shall operate at full cooling capacity.
2. As the room temperature decreases to approximately 75°F., the face and bypass damper shall begin to close to the face of the coil, and the outdoor air damper shall open to admit the minimum amount of air required for cooling. At approximately 72°F., the face and bypass damper shall be fully closed to the face of the coil.



15B-19.21. Cycle of Control for Heating/Cooling Ventilator  
Associated with Direct Radiation-(Cont.)

3. The air discharge thermostat shall be eliminated from the control sequence during the cooling cycle.

15B-19.22. Control of Heating and Ventilating Unit

Heating and ventilating unit shall be started and stopped manually. The outdoor air damper shall open automatically by means of an electro-pneumatic switch whenever the unit starts, and shall close whenever the unit stops. The heating coil valves of the unit shall be controlled by a room thermostat, located where shown on the drawings, acting through a low limit duct thermostat located in the discharge duct of the unit.

15B-19.23. Control of Hot Water Converters

Provide and install normally open pneumatically operated modulating control valves in the steam supply to each hot water converter. The valves shall be controlled in sequence by a submaster thermostat with sensing element in the hot water discharge. Submaster thermostat shall have an adjustable range of 90° to 210° F. water temperature. An outdoor air thermostat shall adjust the submaster thermostat's setting and shall have a range of 60° outdoor air temperature to a range of 90° water temperature. A two-position switch shall be provided to allow the controls to function either under the direction of the outdoor air thermostat or by manual reset of the submaster thermostat. Furnish and install a steel control cabinet, which shall contain the hot water system's thermostats, switches, relays, and temperature indication of outdoor air, supply water, and return water. The outdoor thermostat shall be located in the control cabinet in the Boiler Room, with its sensing element mounted in the location shown on the drawing.

SECTION 15B-20  
THERMAL INSULATION

15B-20.00. General Requirements

- (a) The Contractor shall furnish and install thermal insulation on the piping, ducts and apparatus installed by him which are listed to be insulated, in the manner specified. For performing this insulation work he shall employ a sub-contractor specializing and experienced in thermal insulation work and approved by the Executive Director. Submit samples of pipe, duct, boiler, and breeching insulation for approval.

Note: All insulation materials shall be free of asbestos.

- (b) Prior Tests

Before thermal insulation is applied to piping, apparatus, etc., the tests specified in Paragraph 15B-1.40 shall have been satisfactorily performed. The thermal insulation may be applied to pipes prior to these tests, providing, however, that all fittings are left bare to permit detection of possible leaks. Insulation shall be installed on clean, dry surfaces.

- (c) N.Y.C. Building Code

Duct insulation, pipe insulation, and equipment lining and insulation as well as the adhesives and finishing facings or jackets used therewith shall have a flame spread rating not over 25 without evidence of continued progressive combustion and shall have a smoke developed rating not higher than 50. Flame spread rating and smoke developed rating shall be as defined in the N.Y.C. Building Code. The entire installation of these materials shall meet all requirements of that Code. Adhesives and coatings shall be fire retardant type.

- (d) Approved Manufacturers

Insulation manufactured by Certain-Teed Corp., Johns-Manville, or Owens-Corning Fiberglass Corp., complying with the requirements of the specifications will be approved. Adhesives manufactured by Benjamin Foster Co., Epolux Manufacturing Corp., or Insul-Cooustic (Division of Birma Products Corp.), complying with the requirements of the specifications will be approved. All insulating materials, adhesives, etc. shall be delivered to the project in containers and/or cartons which are clearly marked with the manufacturer's name and brand.

15B-20.01. Piping and Apparatus to be Insulated

The following shall be covered with thermal insulation:

1. All boilers.
2. Smoke breeching and smoke connections, from the boilers to the collars in the openings in the chimneys.
3. All heat exchangers, heaters and air separating tank furnished by this Contractor, excepting the air heating coils specified in Paragraph 15B-15.17.
4. All steam piping throughout, excepting the steam piping in convector enclosures, and drip pockets.
5. Boiler water equalizing line and steam header drips.
6. In piping installations for No. 6 fuel oil, insulate oil flow, oil return, oil suction and oil discharge piping. Do not insulate oil piping in trenches.
7. Water piping installed by this Contractor: cold water, supply and return piping for hot and/or chilled water systems. Do not insulate vacuum pump receiving tank, vacuum pump discharge piping or hot water piping within convector enclosures.
8. The condensate tank. Boiler feed pump discharge piping from pump to a height of 7'-0" above floor.
9. All valve bodies, fittings (except flanges and unions in low pressure steam piping), etc. in piping specified to be insulated. Bonnets of valves in hot and/or chilled water piping shall also be insulated.
10. Hot and/or chilled water circulating pumps.
11. Sprinkler risers concealed in exterior walls of the building.
12. Steam, return, water, and sprinkler piping installed by this Contractor in a location exposed to freezing weather shall be frost-proofed, where indicated.
13. Refrigerant piping within an equipment (or similar) space, from the floor to a height of 7'-0" above floor.
14. In building alterations where existing piping insulation is removed due to piping alterations, the damaged portion of the insulation shall be repaired with new insulation.

15B-20.01. Piping and Apparatus to be Insulated-(Cont.)

Note: Condensate return, drip, vent, sprinkler, and air piping shall not be insulated, unless otherwise specified or indicated on the drawings.

15B-20.02. Thermal Insulation for Piping

- (a) All pipe insulation shall be one-piece, molded sectional fiber glass, having a nominal 4-pound density. Its thermal conductivity shall not exceed 0.23 at 75<sup>0</sup>F. mean temperature. It shall be suitable for use on piping up to 370<sup>0</sup>F. Insulation for steam and hot water piping shall be 1-inch thick for pipe sizes up to and including 3-inches, and shall be 2-inches thick for larger pipe sizes. Insulation for fuel oil, refrigerant, cold and chilled water piping shall be 1-inch thick. Insulation for dual service (hot and/or chilled water) piping shall be of the thickness specified for hot water piping insulation, and shall have the vapor barrier jacket specified for chilled water. All insulation joints shall be firmly butted together.

Note: The use of "Accotherm" pipe insulation, manufactured by Armstrong Cork Co., also is acceptable.

- (b) Valves, fittings, etc. for fuel oil, refrigerant, steam or hot water piping shall be insulated as follows:
1. For pipe sizes smaller than 4-inches, one of the following ways shall be used:
    - A. Apply insulating cement to a thickness equal to adjoining pipe insulation and trowel to a smooth finish.
    - B. Wrap with compressed 1-pound density fiber glass blanket equal in thickness to adjoining insulation. Secure with No. 16-gauge galvanized soft annealed steel wire. Finish with a smooth coat of insulating cement.
  2. For pipe sizes 4-inches and larger, fit segments of pipe insulation and secure with No. 16-gauge galvanized soft annealed steel wire. Finish with a smooth coat of insulating cement.
  3. In lieu of the foregoing methods, the use of pre-molded fiber glass fittings of same thickness as adjoining pipe insulation will be accepted.

15B-20.02. Thermal Insulation for Piping-(Cont.)

(c) Valves, fittings, etc. for chilled water piping shall be insulated with either premolded fiber glass fittings, fiber glass blanket, or with segments of pipe insulation wired in place. In addition, the insulation shall be vapor sealed by applying vapor barrier coating to all cut edges and joints, and then covering the entire fitting with glass fabric tape embedded between two 1/16-inch thick coats of vapor barrier coating. Lap seal glass tape at least 2-inches on itself and adjoining insulation.

(d) Facings or Jackets

1. Refrigerant, fuel oil, steam and hot water piping

Insulation on refrigerant, fuel oil, steam and hot water piping shall have a jacket of white kraft paper outer surface bonded to aluminum foil and reinforced with fiber glass yarn. Kraft paper shall be permanently treated so that it will retain its flame-spread and smoke-developed ratings. Longitudinal laps shall be secured with outward clinch, coated 9/16-inch staples on 4-inch maximum centers. Each edge and end lap of butt strips shall also be stapled. Insulation shall be additionally secured with 3/4-inch wide aluminum bands installed on 12-inch (maximum) centers. Valves, fittings, etc. shall have a jacket of fiber glass fitting cloth smoothly adhered with lagging adhesive. Lap cloth on itself and adjoining insulation: 1-inch lap on 3-inch and smaller pipe, and 2-inches on larger pipe sizes.

2. Chilled water and cold water piping

Insulation on chilled water and cold water piping shall have a vapor barrier jacket of white kraft paper outer surface bonded to aluminum foil and reinforced with fiber glass yarn. Longitudinal laps and butt strips shall be smoothly secured with insulation adhesive. The use of staples on vapor barrier jacketed insulation is not permitted.

Note: The use of pipe insulation having a "self-sealing" lap, and "self-sealing" lap strips is also acceptable.

15B-20.02. Thermal Insulation for Piping-(Cont.)

(e) Frostproofing

Where the drawings indicate piping to be frost-proofed, it shall be insulated with two layers (thicknesses) of molded fiberglass insulation. The outer layer shall be jacketed as specified in Par. 15B-20.02(d) 2. The final insulation shall be protected with a casing of 0.016 minimum thickness aluminum. Where this piping is installed within a furred enclosure, the casing shall be omitted.

15B-20.03. Thermal Insulation for Ductwork

(a) Ductwork shall be insulated in accordance with the following:

1. Heating supply ductwork shall be insulated in its entirety, starting at the discharge of the fan (or blower unit) and terminating at the grille or diffuser, excepting ductwork exposed in the room it supplies. When heating supply ductwork is installed within a hung ceiling any part of which is under a roof, the ductwork shall be insulated for its entire run within that hung ceiling. Heating supply ducts within other hung ceilings or within furred spaces in the interior of the building shall not be insulated.
2. Supply and return ductwork for air conditioning systems shall be insulated in its entirety from the fans (or blower units) to the grilles or diffusers. Recirculation ductwork shall be insulated, beginning at the exhaust fan discharge connection and terminating at the inlet connection to the supply fan. Fans and blower units shall not be insulated.
3. Outside air intake ducts shall be insulated in their entirety.
4. Access doors, test hole fittings, and damper quadrants shall not be insulated except as otherwise specified. The adjoining insulation shall be neatly finished around such devices.

(b) Materials

1. Board Type

Fiber glass board shall be 2-inches thick unless otherwise specified, shall have 3-pound minimum density, and its thermal conductivity shall not exceed 0.23 at 75°F. mean temperature.

15B-20.03. Thermal Insulation for Ductwork-(Cont.)

It shall have a factory applied facing of aluminum foil reinforced with fiber glass yarn mesh and laminated to 40-pound kraft paper which has been chemically treated to give it the permanent flamespread and smoke-developed characteristics required. The use of plain (unfaced) fiber glass board on ductwork serving only as heating supply ducts is also acceptable. Fiber glass board shall be used to insulate ductwork specified in (a), which is not concealed. Fiber glass board shall also be used to insulate ductwork specified in (a) which is installed in fan or equipment rooms or spaces.

2. Flexible Type

Flexible (blanket) type fiber glass duct insulation shall be 2-inches thick unless otherwise specified, shall have 1-pound nominal density, and its thermal conductivity shall not exceed 0.29 at 75°F. mean temperature. It shall have the factory applied foil-reinforced kraft facing specified for fiber glass board. Flexible type duct insulation shall be used to insulate ductwork specified in (a), which is installed in concealed spaces (hung ceilings, furred spaces, pipe and duct spaces, crawl spaces and tunnels).

3. Facing and Finishing

A. Exposed Ducts

1. Insulation on ductwork exposed to view in Boiler Room, Boiler Room Area, Classrooms, Corridors, Custodian's Workshop, Equipment Room, Instructional Areas, Offices, Receiving Room, and finished spaces shall have a facing or finish as specified herein. (For the purpose of this paragraph, "finished spaces" shall be understood to mean those spaces which have plaster, tile or "special coating" finished walls.)
2. Insulation on ductwork not concealed shall be reinforced with metal corner beads and shall have a glass cloth finish installed in the following manner: Brush a full coat of lagging adhesive on all surfaces of the ductwork insulation. Imbed glass cloth in the wet coating, smoothing to avoid wrinkles. Overlap cloth seams 4-inches, locating seams so as to be hidden from view, wherever practicable. Apply a second coat of lagging adhesive.

15B-20.03. Thermal Insulation for Ductwork-(Cont.)

B. Concealed Ducts

Insulation on ductwork installed within pipe and duct spaces, storerooms, hung ceilings, furred spaces, or pipe tunnels shall have no additional finishing, other than the foil-reinforced-kraft facing.

(c) Methods of Installation

1. Installation of Board Type Insulation

- A. Insulation shall be applied with edges tightly butted. It shall be impaled on pins welded to the duct or on stick clips, and secured with speed clips impaled over the pins. Pins shall be cut off close to speed clips. On horizontal ducts, pins shall be spaced not less than one per square foot for the bottom surface, and not less than one per two square feet on the sides and top surface. On vertical ducts, the pins shall be spaced not less than one clip per two square feet of duct surface. For faced insulation, point all joints and cracks with vapor barrier coating, and seal all joints and speed clips with a 3-inch wide strip of foil-reinforced-kraft facing adhered with insulation adhesive. The use of pressure sensitive tape of the same facing material also is acceptable for this purpose.
- B. Where, because of space or size restriction, the welded pin method cannot be used, the use of stick clips will be approved or the insulation shall be secured to the duct with insulation adhesive. The adhesive shall cover the entire surface of the sheet metal when applied to underside of horizontal duct, but may be applied in stripes for application to top and sides with a minimum of 50% coverage. Insulation shall be additionally secured with No. 16-gauge soft annealed galvanized steel wire on not more than 12-inch centers. Continuous metal corner angles shall be used to protect edges of the insulation.



15B-20.03. Thermal Insulation for Ductwork-(Cont.)

2. Installation of Flexible Type Insulation

Flexible type insulation shall be cut slightly longer than the perimeter of the duct to insure full thickness at corners. Insulation shall be applied with edges tightly butted, and it shall be secured with insulation adhesive. Adhesive shall be applied so that the insulation conforms to duct surfaces uniformly and firmly. Insulation shall be additionally secured with No. 16-gauge soft annealed galvanized steel wire on not more than 12-inch centers. When the width of a horizontal duct is 48-inches or more, the insulation shall also be fastened with welded pins or stick clips spaced on 24-inch centers on the bottom surface of the duct. All joints and clips shall be taped and sealed with 3-inch wide strips of foil-reinforced-kraft facing applied with insulation adhesive. The use of pressure sensitive tape of the same facing material also is acceptable for this purpose.

(d) Insulation for Warming Pantry Hood Exhaust Duct.

Warming Pantry hood exhaust ductwork shall be insulated, beginning at the hood connection and ending at its connection to the flue to the roof. Insulation shall be board or flexible type fiber glass, as specified in (b). Other ducts joining the Warming Pantry hood exhaust duct shall not be insulated.

(e) Insulation for Kitchen Range Hood Exhaust Duct.

The exhaust duct from the Kitchen Range Hood shall be insulated between the hood and the chimney or flue in the same manner as is specified for the boiler smoke breeching in Par. 15B-20.05, except that the thickness of the insulating block shall be 2-inches. Other ducts joining the Kitchen range exhaust duct shall not be insulated.

15B-20.04. Thermal Insulation for Boilers

Each boiler shall be insulated on all surfaces, including the front and rear smoke boxes, but excluding the doors, manholes, handholes, and the area of the boiler front marked with maker's name, pressure, identifying marks, symbols, etc. The insulation shall consist of 1½-inch thick asbestos free calcium silicate block, with vertical joints staggered, and held in place with No. 16-gauge galvanized steel wire. Wire shall be secured to holes provided for this purpose in the frames around handholes, manholes, doors, base, etc. Over the insulating block

15B-20.04. Thermal Insulation for Boilers-(Cont.)

shall be applied 2-inch mesh hexagonal galvanized wire netting and a  $\frac{1}{2}$ -inch thick coating of insulating and finishing cement troweled to a smooth, hard finish. Provide galvanized steel corner beads at all outside corners. Access plates at back and bottom of rear smoke box shall not be insulated.

15B-20.05. Thermal Insulation for Boiler Smoke Breeching

Smoke breeching and all boiler connections thereto shall be insulated in accordance with the following: Secure V-ribbed wire lath to all surfaces, the ribs providing a 1-inch air space between the breeching and the metal lath. Outside the lath, install  $1\frac{1}{2}$ -inch thick asbestos free calcium silicate blocks, securely held in place with No. 16-gauge galvanized steel wire. Over this, fasten 2-inch mesh hexagonal galvanized wire netting and apply a  $\frac{1}{2}$ -inch thick coating of insulating and finishing cement troweled to a smooth, hard finish. Provide galvanized steel corner beads at all outside corners. Wire lath shall be No. 21-gauge galvanized steel, having  $2\frac{1}{2}$  meshes to the inch. V-ribs shall be of galvanized steel, and shall be located on 8-inch maximum centers. Copper bearing black steel wire lath is also acceptable. Expansion joints, smoke indicators, the end of the sequence damper housing on which bearings are mounted, test openings, and clean-out doors shall not be insulated, and the adjoining insulation shall be neatly beveled around such equipment.

15B-20.06. Thermal Insulation for Water Circulating Pumps

- (a) Each water circulating pump shall be insulated in the manner specified herein. Insulation shall not be applied until the pump has been connected, tested, and found to be operating satisfactorily. All surfaces of the pump to be insulated shall be clean and dry. Care shall be taken to prevent the entrance of any insulating material into the pump, motor, lubricating ports, venting petcocks, etc.
- (b) Insulation shall be 1-inch thick, 5-pound density rigid fiber glass board with vapor barrier facing, and shall have a thermal conductivity not exceeding 0.24 at 75°F. mean temperature. Insulation shall be held in place with No. 16-gauge soft annealed galvanized steel wire. Joints and voids in the insulation shall be filled with mineral wool cement. Joints and breaks in the vapor barrier shall be sealed by applying vapor barrier coating. Finish shall consist of embedding open weave glass fabric (20 x 20) into a wet coating of lagging adhesive, overlapping the seams at least 2-inches. A finish coat of lagging adhesive shall then be applied to the entire insulated surface.

15B-20.07. Thermal Insulation for Condensate Receiving Tank

- (a) The condensate receiving tank of the boiler feed system shall be insulated in the manner specified herein. Insulation shall not be applied until the tank has been connected and tested. All surfaces of the tank shall be clean and dry.
- (b) Insulation shall consist of 1½-inch thick asbestos free calcium silicate block, with vertical joints staggered, and held in place with No. 16-gauge galvanized steel wire. Wire shall be secured to holes in insulation bars provided for this purpose on the tank. Over the insulating block shall be applied 2-inch mesh hexagonal galvanized wire netting and a ½-inch thick coating of insulating and finishing cement, troweled to a smooth, hard finish.

15B-20.08. Insulation for Outdoor Ductwork

Outdoor ductwork shall be insulated with board type insulation having a vapor barrier facing as specified in Par. 15B-20.03. After the insulation has been installed, it shall be coated with a 1/8-inch thick layer of fire retardant vinyl acrylic insulation mastic (the equal of Cadalon 500, manufactured by Epolux Mfg. Co.). Into this layer of mastic, embed 10 x 10 mesh glass fabric. Over the fabric, apply another 1/8-inch thick layer of insulation mastic, troweled to a smooth finish.

15B-20.09. Insulation for Heat Exchangers

Heat exchangers (hot water converters, etc.) shall be insulated in the same manner as specified for condensate receiving tank in Par. 15B-20.07.

SECTION 15B-21  
PAINTING WORK

15B-21.00. General Requirements

- (a) The Contractor shall paint boilers, tanks, machinery, apparatus, equipment, radiation, piping, duct work, coverings, hangers, supports, foundations, etc. provided by him, except otherwise specified. For performing this work, he shall employ an experienced sub-contractor specializing in painting work and approved by the Executive Director.
- (b) Boilers, boiler fronts, fuel oil storage tanks, convector enclosures, brackets, stands, fans, grilles, etc., shall be given shop coats of paint at the factory before shipment as specified on other sections of the specification. Where a priming coat or other painting is specified under other sections of the specification, such coat shall not be considered as one of the coats of paint specified in this section.
- (c) Piping, duct work, covering, etc., concealed in hung ceilings, in furred spaces, in convector enclosures and in inaccessible locations are not required to be painted at the site. However, piping, duct work, insulation facing, etc., located in accessible spaces in basement, pipe space, crawl space or cellar shall be painted as specified. Piping in trenches and piping laid in the ground shall also be painted as specified.

15B-21.01. Painting Materials

- (a) Materials
  - 1. Painting materials shall be factory mixed and shall be delivered to the premises in original sealed containers, with unbroken seals. Containers shall bear the name and trade brand of the manufacturer and must indicate compliance with Federal Specifications, as noted below. Materials shall be approved by the Executive Director before they are used. Before beginning the painting work, Contractor shall submit an affidavit to the Executive Director stating that all materials he proposes to use comply with this specification.
  - 2. Materials shall comply with the requirements of Federal Specification TT sections as follows:

15B-21.01. Painting Materials-(Cont.)

Aluminum Paint (ready mixed).....	P-0038c
Asphaltum Paint.....	V-51c
Black Paint.....	P-61d
Colors in Oil.....	P-381c(2)
Enamel Undercoat.....	E-543a
Galvanized Iron Primer.....	P-641f
Gloss Enamel.....	E-489f
Iron (Red) Oxide.....	P-31c
Latex Base Paint.....	P-29h
Lead, Zinc and Titanium Paint.....	P-102b
Turpentine.....	T-801c
Zinc Chromate Primer.....	P-636b

(b) Tests

At the discretion of the Executive Director, chemical and physical tests will be made in accordance with "Standard Method of Tests" as specified in Federal Specifications governing the particular materials. One laboratory test of each of five different paint materials will be made by an approved laboratory selected by the Executive Director. The Contractor shall include in his Bid Price, the cost of these tests. Materials that do not meet test requirements will be rejected. When replacement of rejected material has been delivered to the premises, samples of new material shall be taken for tests. Costs of additional tests, required because of rejection of materials, shall be borne by the Contractor. Executive Director will require five samples of painting materials taken from original containers, on the premises, for these laboratory tests. Furnish new, clean, friction top, tinned cans of one quart size for each sample. Mix contents of each container thoroughly before sample is taken.

15B-21.02. Storage of Materials

Painting materials shall be stored only in assigned spaces which shall be maintained in a clean condition, safe from fire hazards and meeting regulations of the Fire Department. The floors of assigned spaces shall be protected from paint damage by use of drop cloths or building paper. Any waste material such as oily rags, empty paint cans, etc., shall be removed from site each night. Executive Director to be provided with one (1) key for each of these spaces if they are to be locked.

15B-21.03. Workmanship

(a) Application

Paints shall be applied in a careful manner by painters experienced and skilled in their trade. Materials or work to which paint is to be applied, whether in factory, in shop, or at the site, shall be properly prepared to receive the same. The surfaces shall be dry, free from foreign matter, dirt, cement, plaster, grease, oil, loose paint, scale, scratches, finger marks, pencil marks, etc. The various surfaces shall be sandpapered or rubbed before and between coats as required to produce a satisfactory surface. No paint, etc., shall be applied until the preceding coating is thoroughly dry. Paint shall be evenly spread and well brushed out. It shall be so applied as to eliminate drops, runs, or sagging of materials. Enamel shall be evenly and smoothly flowed on. Painting at the site shall not be commenced until ordered by the Executive Director.

(b) Protection

Drop cloths shall be used to prevent drops of paint, oil, etc., from defacing the painted walls, woodwork, floors, stairs, convectors, furniture, etc. Contractor shall be particularly careful not to get paint on name plates, valve tags, and on other finished surfaces. Paint spots shall be properly removed from glass, floors and finished surfaces.

(c) Inspection

Each separate application or coat of paint or enamel shall be left until it has been inspected and approved by the Executive Director before another coat is applied. Each coat of paint applied prior to finishing coat shall be of a shade different from preceding coat, as directed, and from final coat.

(d) Colors

The colors for the various portions of the work shall be as selected by the Executive Director.

(e) Damaged Work

Where the finish of the woodwork, plaster, etc., of the building has become discolored, marred, damaged, or otherwise destroyed in the performance of this contract, the same shall be refinished, painted, or varnished, as the case may be, in the best manner of such work and in every respect equal to the work previously existing.

15B-21.04. Painting for Boiler Equipment, Etc.

The boiler front, fixtures and fittings around boilers, steel supports, platforms, ladders, railings, hoists, etc., furnished under this contract shall be given a prime coat of red oxide paint or zinc chromate paint, and a finish coat of aluminum paint, applied after completion of the installation.

15B-21.05. Painting for Masonry Foundations

Masonry foundations built by this Contractor shall be painted above the floor with two (2) coats of latex paint, color selected.

15B-21.06. Painting for Fuel Oil Storage Tanks

Refer to Paragraph 15B-7.18(e).

15B-21.07. Painting for Pumps, Tanks, Fans, Etc.

Pumps, fan housings, motors, tanks, air compressors, air storage tanks, auxiliary appliances, and exposed metal supports, framework, etc., furnished and installed under this Contract shall be given a shop priming coat of rust inhibiting paint standard with the manufacturer, and after all other work is finished, one (1) coat at the site with lead and oil paint, of color selected. Shop coat painting for fans shall be as specified in Paragraph 15B-15.00(g). Fan housings made of aluminum or fiber glass shall not be painted. Equipment finish-painted at the factory may not be required to be painted over at the site, provided finish painting is not damaged and is in good condition at completion of project.

15B-21.08. Painting for Convector Enclosures

Convector enclosures shall be painted at the factory as specified in Par. 15B-12.03.

15B-21.09. Painting for Uninsulated Piping

(a) General

Excepting for brass piping around boilers, which shall not be painted, exposed uninsulated piping, including hangers, installed by this Contractor throughout the building, shall be cleaned and then given one (1) coat of primer and one (1) coat of enamel in finished rooms, color to match the surroundings. In unfinished spaces, aluminum paint shall be used in place of enamel.

15B-21.09. Painting for Uninsulated Piping-(Cont.)

(b) Sprinkler Piping

Exposed sprinkler piping shall be painted with a priming coat and then with two (2) coats of lead and oil paint of color as directed. Sprinkler heads shall be protected during painting with small paper bags. Painting of sprinkler piping, hangers, etc., shall conform with code requirements.

(c) Air Piping

Exposed pneumatic valves and air piping in finished rooms in and above basement or cellar shall be painted. Conduit or troughing enclosing pneumatic tubing shall be painted in finished rooms and in fan or equipment spaces. Other air piping shall not be painted.

(d) Piping in Trenches

Piping in floor trenches within the building shall be painted after fabrication with one (1) coat of black asphaltum paint.

(e) Piping Buried in the Ground

Piping buried in the ground including the underground piping for oil storage tanks, shall be protected with one (1) coat of black asphaltum paint.

15B-21.10. Painting for Uninsulated Sheet Metal Work, Etc.

(a) Exposed, uninsulated duct work in finished rooms, throughout the building will be painted by the Contractor for General Construction, unless specified otherwise.

(b) All other exposed uninsulated galvanized duct work, casings, shields, guards, etc., together with safings, hangers, framework, etc., in connection therewith, shall be thoroughly cleaned and painted with one (1) coat of galvanized iron primer, gray in color and one (1) coat of aluminum paint. The inside of duct work, where visible through grilles, shall be given one (1) coat of primer and one (1) coat of flat black paint. Painting of ducts behind bar type grilles which are located more than six feet above floor is not required. Galvanized steel exposed to the weather shall be thoroughly cleaned, then painted with one coat of galvanized iron primer and two coats of lead, zinc and titanium paint, finish color as directed.



15B-21.10. Painting for Uninsulated Sheet Metal Work, Etc.-(Cont.)

(c) Ventilators for outside air intake, exhaust discharge, roof ventilators, and aluminum and plastic housings for roof type fans shall not be painted.

(d) Grilles, Etc.

Grilles shall be provided with a priming coat at the factory. The Contractor for General Construction will apply the finish painting of grilles in finished rooms. If the grilles are not installed by this Contractor before the surrounding surfaces are repaired or painted, then the grilles shall be painted by this Contractor with two (2) coats of lead and oil paint color to match the surroundings. Aluminum grilles shall not be painted.

(e) Boiler Smoke Breechings

Boiler smoke breechings shall be painted with one coat of approved heat resisting aluminum paint at the shop or immediately after erection, before they are insulated.

15B-21.11. Painting for Insulated Piping, Ductwork, Boilers, Breechings, Etc.

(a) Two (2) coats of latex fire retardant paint shall be applied to exposed insulated piping, to boilers, boiler breeching, tanks, pumps, and to the glass cloth finish on insulated ductwork. Color of paint shall be light gray, except in finished spaces where it shall match the color of the adjacent surroundings. Fire retardant paint shall be as manufactured by Cheesman-Elliot Co., Glidden, PPG Industries or other U.L. listed approved equal.

NOTE: In an existing building, when the above listed insulation is repaired or replaced, the color of the paint shall be blue, to identify it as non-asbestos insulation.

(b) Glass or synthetic fabric necks at connections to air handling units and fans shall not be painted or oiled. Canvas necks shall be oiled with one coat of neat's-foot oil.

SECTION 15B-22  
VIBRATION ISOLATION

15B-22.00. General

- (a) Provide a complete system of vibration isolation for each item of HVAC equipment and piping, as specified in this Section. All isolating materials for the project shall be the product of one approved manufacturer and shall be installed in accordance with his instructions. The manufacturer shall determine mounting sizes, guarantee noted deflections and, where necessary, shall provide field supervision and inspection to insure proper installation and performance.
- (b) For vibration isolation equipment installed indoors, all metal parts, including rails and bases, shall be painted at the factory with one coat of red oxide paint and one coat of aluminum paint. Other means or rust resisting painting may be accepted, subject to prior approval.
- (c) Vibration isolation equipment installed outdoors shall have all steel parts hot dipped galvanized, all bolts cadmium plated, and all springs cadmium plated and neoprene coated.

15B-22.01. Approved Manufacturers

Vibration isolators and bases manufactured by Korfund Dynamics Corp., Mason Industries, Inc., Vibration Eliminator Co., or Vibration Mountings and Controls, Inc. conforming to the requirements of the drawings and specifications will be approved. Contractor shall submit for approval complete shop drawings for the vibration isolating supports required for each item of HVAC equipment. Shop drawings shall fully illustrate the types of isolation supports and equipment bases being furnished, and the static deflection and efficiency to be attained.

15B-22.02. Installation

- (a) At each equipment location, provide the required deflection under the imposed load and produce uniform loading and deflection even when equipment weight is not evenly distributed. Jack inertia blocks and bases into position and wedge in place before spring loading; leveling bolts shall not be used as jacking screws. After equipment is in place and springs are loaded through leveling bolts, remove wedges and jacks. Isolators shall be suitable for the lowest operating speed of the equipment.

15B-22.02. Installation- (Cont.)

(b) Where the floor is waterproofed or finished with waterproof cement, install vibration isolation in such manner that the waterproofing is not damaged.

(c) Isolation equipment shall be in accordance with the following table:

<u>Lowest RPM</u>	<u>Inches Deflection</u> (Min.)	<u>% Efficiency</u>	<u>Type</u>
1750 & over	.25	95	Single neo- prene-in-shear
1200-1749	.50	95	Double neo- prene-in-shear
1000-1199	.75	95	Spring
570-999	1.25	90-95	Spring
520-569	1.5	90	Spring
330-519	2.0	80-90	Spring
Up to 329	3.5	80	Spring

15B-22.03. Spring Mounts

(a) Spring type mounts shall consist of cast telescoping housings containing one or more steel springs. The mount shall be provided with built-in leveling bolt(s), resilient inserts of neoprene to act as guides for upper and lower housings and with ribbed neoprene acoustical pads bonded to the bottom of the lower housing. The lower housing shall have slotted holes in the base, to permit fastening of the mount to the floor when specified. Housed spring mounts shall be used for certain air moving equipment, and for chillers located in cellar or basement. Refer to Par. 15B-23.02 and 15B23.09.

(b) Free standing spring mounts shall be laterally stable without housing. Each mount shall be provided with a leveling bolt, a ribbed neoprene pad on the underside of the base, and means of securing the spring base to the floor when specified. Free standing spring mounts shall be used where a floating pad system or an inertia block is specified.

15B-22.04. Neoprene-in-Shear Mounts

Each neoprene-in-shear type mount shall consist of a steel top plate and steel base plate completely enclosed in oil resistant neoprene. Top plate shall have a threaded bolt hole for attachment of equipment to mount. Base plate shall have bolt holes, to permit fastening of the mount (Cont.)

15B-22.04. Neoprene-in-Shear Mounts-(Cont.)

to the floor when specified. Underside of base plate shall have ribbed, neoprene construction. Single neoprene-in-shear mounts shall have a maximum deflection of 0.25-inches. Double neoprene-in-shear mounts shall have a maximum deflection of 0.50-inches.

15B-22.05. Hanger Type Isolators

- (a) Hanger type isolators shall consist of a steel housing incorporating a single or double neoprene-in-shear element or a steel spring, or a combination of these two isolators, as needed to achieve the required static deflection. Provide threaded rods for attachment of hanger to overhead structure and to equipment.
- (b) Install combination spring and double deflection neoprene position hangers for the suction and discharge piping at each circulating pump in the hot and/or chilled water system. Each hanger shall be located on the pump side of the flexible hose connection specified in Par. 15B-8.01(1).
- (c) Install combination spring and double deflection neoprene position hangers for all refrigeration piping located in the Equipment Room.

15B-22.06. Steel Bases

- (a) Integral structural steel bases for belt driven centrifugal fans shall be rectangular in shape, and each member shall be of wide flange beam or channel shaped cross-section. Bases for fans having motors in the X or Y position may be of "L" shape configuration. Depth of section shall be equal to a minimum of 1/10th of the longest span of the equipment. Built-in adjustable motor slide rails shall be furnished as an integral part of the base. Joints shall be continuously welded.
- (b) Structural steel bases under air handling units shall be wide flange beams of size specified, or shown on drawing. Two beams shall be provided for an air handling unit, one under each side along the length of the unit and extending 6-inches beyond the ends. A steel bearing plate, 3/8-inch thick, shall be welded to the top flange of the beams at the location of each vibration isolator. The isolator shall be bolted to the bearing plate.

15B-22.07. Inertia Blocks

An inertia block shall consist of a rectangular shaped reinforced concrete block on which pumping equipment shall be mounted and which shall be supported on spring isolators above the floor. The pouring form for the block shall be made of 6-inch (minimum height) steel channels welded together and shall include reinforcing bars running in two directions, welded in place or welded wire fabric. Anchor bolts for the pump's base shall be secured within the pouring form. The number and location of brackets for mounting isolating springs shall be determined by vibration isolation manufacturer. Pouring form shall include space for the pump inlet base elbow. Concrete shall be poured at the site by the HVAC Contractor. Design and fabrication of the pouring form, including all of its parts, shall be the responsibility of the vibration isolation equipment manufacturer. Pump support shall be designed to provide 95% (minimum) vibration isolation.

15B-22.08. Floating Pad System

- (a) Floating pad system shall be constructed in the manner indicated on the drawings and as specified. The floating pad shall be isolated from the building structure by means of 2-inch high neoprene isolators, factory bonded to the underside of ½-inch thick exterior grade plywood. Placement and density of isolators shall be in accordance with load requirements and with recommendation of vibration isolation manufacturer. Line interior face of the curb with 1-inch thick light density cork. Cover the plywood form with a sheet of polyethylene film, overlapping the cork boards and curbs. Pour a 6-inch thick reinforced concrete pad on top of the polyethylene film, inside the cork boards. After the concrete has set, remove the excess polyethylene film, and fill the joint between the pad and the curb with 3-M Co.'s EC-801, or equivalent mastic seal.
- (b) Each liquid chiller unit shall be installed on the concrete pad on free-standing spring type isolators having a static deflection of at least 1-inch. Isolators shall provide a minimum isolating efficiency of 95%.

15B-22.09. Schedule

Provide vibration isolation supports for HVAC equipment as indicated in this schedule.

<u>Equipment</u>	<u>Location</u>	<u>Type of Support</u>
Centrifugal fan, belt driven	floor mounted	integral steel base with isolators
Multizone unit	floor mounted	springs on 6" W. F. beams
A.C. single zone unit (vertical)	floor mounted	springs on 6" W.F. beams
H.&V. unit (vertical)	floor mounted	springs on 6" W.F. beams
H.&V. unit (horizontal)	floor mounted	springs on 10" W.F. beams
A.C. single zone unit (horizontal)	floor mounted	springs on 10" W.F. beams
Air handling unit	overhead supported	spring and double deflecting neoprene hangers
Chiller, reciprocating	cellar/basement	springs with 2" min. static deflection
Chiller, reciprocating	upper floor	floating pad
Pump, all H.P.	cellar/basement	none required
Pump, 5 H.P. or more	upper floor	inertia block
Pump, under 5 H.P.	upper floor	none required
Pipe, refrigerant	equipment room	spring and D.D.* hanger
Pipe, hot and/or chilled water	at pumps	spring and D.D.* hanger

\*D.D.=Double Deflecting

SECTION 15B-23  
REFRIGERATION EQUIPMENT

15B-23.00. General

(a) Scope

Furnish and install labor, materials and equipment for the installation of a complete system for the production of chilled water as described herein and as shown in the drawings. The system shall be complete with all necessary refrigeration equipment, such as compressors, evaporators, condensers, receivers, mufflers, special controls, gauges, thermometers, control panel, valves, strainers, piping, R-22 refrigerant charge, etc., all as hereinafter specified, shown on the drawings or required for a complete installation.

(b) Rules, Permits, Etc.

Permits necessary for work in connection with the installation of the refrigeration equipment and the operation thereof shall be obtained by this Contractor, free of charge to the Board of Education from the Department of Buildings, Fire Department, Bureau of Gas & Electricity, and any other municipal agency having jurisdiction. Work and materials (including the installation of instruction signs) shall conform with the latest requirements of these departments. Contractor's attention is directed to the requirements of Article 13 of the current edition of the Building Code.

NOTE: Refrigeration equipment such as chillers, condensers and condensing units shall have been accepted by the Materials and Equipment Acceptance Division of the Department of Buildings, and the MEA acceptance number shall be indicated on the shop drawings.

(c) Installation and Adjustment

1. Refrigeration equipment shall be installed under the direction of the package chiller manufacturer's representative. All adjustments, alterations, etc., necessary to make the apparatus fully operative for the purposes intended, shall be made.
2. The chiller manufacturer shall furnish the services of a factory trained representative for a total of two consecutive normal working days to supervise the pressure testing, evacuation (if other than R-22 is used for pressure testing)

15B-23.00. General-(Cont.)

charging, and initial start-up of the unit, and to concurrently instruct the Custodian. He shall also deliver to the Custodian at this time a complete written set of installation and operating instructions, a copy of which shall be submitted with the shop drawings.

(d) Drawings

A complete system layout drawing indicating all piping, wiring, accessories, etc., required for the particular package chiller, etc. installed, together with complete details and drawings of chiller, air-cooled condenser assembly, pressure vessels, regulating valves, strainers, etc., shall be submitted and approved before installation. Layout drawings shall have received prior approval of manufacturer of package chiller, and such approval shall be indicated on the drawing.

(e) Piping and Wiring Diagrams

A complete wiring diagram and a piping layout for the chilled water system shall be framed and mounted where directed in the Equipment Room. All parts of the installation shall be indicated exactly as installed and properly identified. Valve identification numbers shall agree with valve tags and all piping shall be plainly marked on drawings. See Paragraph 15B-9.08. Shop drawings shall not be provided with valve identification numbers. Frame shall be of aluminum, satin finish, with one side of frame removable, and with a plywood backing. Single thick glass front shall be provided.

15B-23.01. Equipment Guarantee and Inspection

- (a) In addition to the terms of the guarantee provided for in Section 15B-1, the Contractor shall guarantee the chiller and air cooled condenser installation, including controls, for a total period of two (2) years from the date of initial start-up of the system. The guarantee shall include the parts, including refrigerant, and labor to inspect, repair and adjust all components of the chiller and air cooled condenser installation. Inspections, repairs and adjustments shall be performed by mechanics employed by the chiller manufacturer or by his authorized service representative.



15B-23.01. Equipment Guarantee and Inspection-(Cont.)

(b) Inspections and Adjustments.

Four regular inspection and service calls shall be made each year. One call shall be made at start-up, another at season shutdown, and the other two calls shall be made at equally spaced intervals during the cooling season. Each regular inspection call shall include the following services:

1. Check refrigerant charge and add, as required.
2. Check oil level in each compressor crankcase, and bring to proper level as required.
3. Check all temperatures and pressures. Adjust as required to comply with manufacturer's standards.
4. Check all operating and safety controls. Adjust or replace any control that does not function in accordance with manufacturer's specifications.
5. Check each condenser and each evaporator coil.
6. Check and adjust belts for proper tension and alignment. Clean as required.
7. Lubricate equipment as required.
8. Annually, drain crankcase, clean sump, replace filter and refill with proper oil as recommended by manufacturer.

(c) Emergency Service Calls

In addition to the four regular inspection calls specified in (b) emergency calls shall be made on demand when malfunction occurs.

(d) Reports

At the conclusion of each visit, the service representative shall deliver to the Executive Director's representative, a written report of the services he has performed and any additional work that is required or recommended.

(e) Repairs

The chiller manufacturer (or his authorized service representative) shall perform all required repairs on the specified refrigeration equipment without additional cost to the Board of Education. Repairs

15B-23.01. Equipment Guarantee and Inspection-(Cont.)

shall include, but not be limited to, the following, except where otherwise excluded by sub-paragraph (f):

1. Furnish all supplies, replacement parts, refrigerant and labor. This includes heat exchangers and tubes.
2. Maintain insulation on the refrigerant piping and equipment as supplied by the manufacturer.
3. Maintain pressure and temperature controls, thermometers, gauges, control devices, thermostats and manual valves as supplied by the manufacturer and located at equipment.
4. Motor starters supplied in the original equipment.
5. Compressors and condensers.
6. Steam clean condensers and evaporator coils when required.

(f) Exclusions

The inspections, service, maintenance and repair called for under this paragraph do not include the following:

1. Normal daily and weekend functions of stopping and starting the refrigeration equipment covered hereunder. Replacement of fuses. Operation of reset buttons.
2. The guarantee of room conditions or (air conditioning) system performance unless improper conditions are directly due to the failure of the mechanical equipment covered hereunder.
3. Piping, other than refrigerant piping.

Note: Nothing in this paragraph shall be understood as relieving the Contractor of his obligations as specified in Par. 15B-1.14, "Guarantees".

- (g) The guarantee time shall begin when the refrigeration equipment is initially started (as specified in Par. 15B-23.00(c)(2) and shall expire two (2) calendar years after that date. The HVAC Contractor shall give written notice to the Executive Director at least two days before the initial start-up.
- (h) The Contractor shall submit with his application for payment, at time of initial start-up, three (3) copies of the guarantee issued by the manufacturer of the refrigeration equipment or his authorized service representative.

15B-23.02. Package Chiller

(a) General

Furnish and install hermetic reciprocating package water chillers in the location and of the number and capacity shown on the drawings. Each unit shall be complete with compressor(s), insulated chiller, starter, dual pressure switch, differential oil pressure switch, expansion valve, solenoid refrigerant valve, safety thermostats, temperature controller, pressure relief valves, charging valves, sight glass, oil strainer, liquid line drier and strainer, discharge, suction and oil pressure gauges with shut-off valves. Operational indication lights for power on, oil failure, hi-lo pressure cut-out, and low temperature cut-out shall also be included.

(b) Compressor

1. The compressor in the package chiller shall be the accessible hermetic, reciprocating type with 1750 rpm, 208-volt, 60 cycle, 3-phase motor. The compressor shall start unloaded, and shall have 3-step (minimum) capacity modulation, controlled either by suction pressure or by chilled water inlet temperature. Compressor shall have forced feed lubrication, utilizing a positive feed reversible oil pump. Suitable means shall be provided to insure against possibility of damage due to presence of refrigerant liquid in compressor. Compressor motor shall have at least two hermetic thermostats located in the motor windings to prevent motor overheating. Compressor motors exceeding 25 horsepower size shall be designed for part-winding start.
2. Compressor starter shall be furnished in accordance with Paragraph 15B-23.11(a). (The use of a starting contactor with an external thermal overload system may be approved. Submit details.) Provide a phase-failure-phase-reversal relay for each compressor starter. This relay shall be current type of proper size, the equal to Allen-Bradley Bulletin 812. Provide on/off switch in cover of each compressor starter. A chiller having multiple compressors shall be provided with a fused disconnect switch, mounted on or near the chiller, for each compressor motor. Also provide all auxiliary contacts required for control equipment, as specified in other paragraphs of this section, as well as an auxiliary contact for flow switch, specified in Par. 15B-11.13.

15B-23.02. Package Chiller-(Cont.)

(c) Chiller

The chiller shall be direct expansion, shell-and-tube type. It shall be completely covered with an insulating material complying with the requirements of the N.Y.C. Building Code. Tubes shall be of copper, with finned inserts. Chiller shall be constructed in accordance with A.S.M.E. code for unfired pressure vessels, and shall be tested, inspected and stamped accordingly. Chiller shall be shipped with a positive dry nitrogen holding charge.

(d) Control Panel

Package chiller shall be equipped with a factory installed and wired control panel containing the starters, pressure switches, temperature controls, pilot lights, and other associated electrical equipment required for proper operation of the system as designed.

(e) All components of the package chiller, including accessories, shall be factory tested for performance prior to shipment. Controls and connections shall be clearly marked. Chillers shall be installed on vibration absorbing supports, as specified in Par. 15B-22.09. See the drawings.

(f) Package chillers manufactured by Bohn Heat Transfer Division of Gulf & Western Metal Forming Co., Carrier Corp., Dunham-Bush Inc., McQuay-Perfex Inc., The Trane Co. and York Division of Borg-Warner Corp. and complying in all respects with the requirements of the drawings and specifications will be approved. Manufacturer's model numbers will be given in a later amendment.

Note: Package chillers and air cooled condensers shall be products of the same manufacturer.

15B-23.03. Oil Separator-Muffler

Furnish and install in the discharge of each compressor, a muffler and an oil separator, or a single device combining two functions. The muffler-separator shall function to reduce hot gas pulsations and to extract oil entrained in the hot refrigerant gas and return it to the compressor oil supply. It shall be constructed in accordance with ASME Code, and shall be sized to suit the compressor furnished. Muffler-separator shall be furnished by the chiller manufacturer and shall be installed complete with piping, valves, brackets, etc. as recommended by him.

15B-23.04. Air Cooled Condensers

- (a) Furnish and install remote, vertical discharge air cooled condensers of capacity and size shown on the drawings. Each condenser shall be complete with condenser coil, fans, motors and controls contained in a casing of No. 16-gauge (minimum) steel. Casing shall have a phosphatized, or equal, treatment and shall be furnished with two coats of alkyd enamel or other approved corrosion resistant paint. Aluminum casing of not less than No. 12-gauge also is acceptable. Provide access panels to motors, drives and coil connections.
- (b) Coils shall be made either of all aluminum or of copper tubes with mechanically bonded aluminum fins. Coils shall be factory leak tested, dehydrated and shipped with a positive dry holding charge.
- (c) Each condenser shall be equipped with propeller type fans, either direct or belt driven. Direct drive fans shall have aluminum blades with zinc coated steel hub and shaft. Belt driven fans shall have zinc plated steel blades with iridite dip, and shall be equipped with lubricated pillow block ball bearings. Motors shall be drip-proof type and shall be provided with thermal overload protection. Fan discharge shall be fitted with close mesh electro-galvanized or aluminum fan guard.
- (d) Each condenser shall be installed on the roof in the location shown on the drawings. The condenser shall be installed with legs field welded or bolted to structural crossmembers provided by this Contractor. Crossmembers shall be sized to carry the load imposed by the fully charged condenser, and shall have the minimum dimensions of 8WF 13 beams. Crossmembers shall be field welded or securely bolted by this Contractor to structural base provided by others. Painting of crossmembers will be done by others.
- (e) Each condenser fan motor shall be provided with a combination starter and disconnect with fuse protection required by distribution. Starter-disconnect shall be in accordance with Par. 15B-23.11(c), and shall be contained in a weatherproof NEMA enclosure, mounted on the condenser.
- (f) Air cooled condensers manufactured by Bohn Heat Transfer Div. of Gulf & Western Industries, Carrier Corp., Dunham-Bush, Inc., McQuay-Perfex Inc., Trane Co. or York Div. of Borg-Warner Corp. and complying with the requirements of the drawings and specifications will be approved. Model numbers will be given in a later amendment.

15B-23.05. Head Pressure Control

An automatic head pressure control system shall be furnished and installed complete with all required auxiliaries, controls and piping as part of each refrigeration system. The control system shall function to permit operation of the refrigeration system at ambient temperatures as low as 45°F. The head pressure control shall be a product of the manufacturer of the package chiller unit and shall be installed in accordance with his recommendations, with working parts accessible for maintenance. Submit details of head pressure control system as part of the layout drawings required under this Section.

15B-23.06. Liquid Receivers

Furnish and install on each chiller unit, a refrigerant liquid receiver built in accordance with ASME Code for Unfired Pressure Vessels. Receiver shall be sized in accordance with manufacturer's recommendation to hold the complete refrigerant operating charge of the system. Receiver shall be provided with isolating valves, and with a suitable relief device. One receiver shall be provided for each package chiller.

15B-23.07. Chilled Water Temperature Controls

- (a) Furnish and install a system of chilled water temperature control which will sense return water temperature and will function to energize the control circuits of the two chillers in sequence to maintain desired chilled water operating temperature. Controls shall incorporate a lead-lag feature, and shall permit the controlled operation of either or both chillers.
- (b) The intended sequence of operation for the refrigeration equipment is as follows:
  1. Starting

Crankcase heater of each compressor shall be energized 24-hours before starting any refrigeration equipment. First, one chilled water circulating pump shall be started, then the lead chiller shall be selected by means of the lead-lag switch. Next, the control switch of the lead chiller shall be turned to the "ON" position, starting its condenser fans and then its compressor. After a time interval of approximately 30-seconds, the control switch of the lag chiller shall be turned to the "ON" position, starting its condenser fans and then its compressor. When the return chilled water temperature falls to 45°F., the lag chiller's

15B-23.07. Chilled Water Temperature Controls-(Cont.)

compressor will pump down, then the compressor and its condenser fans will shut off. If the return water temperature rises above 55°F., the lag condenser fans and then the lag chiller will start, to handle the load.

- NOTES: 1. Operator shall select the lead chiller at each daily start-up.
2. The system must not work unless a chilled water circulating pump has been started, the lead chiller has been selected, the lead condenser fans started, and the lead compressor started, all in that order.

2. Stopping

Control switches of chillers shall be turned to "OFF" position, stopping compressors and condenser fans. The chilled water circulating pump shall be stopped. The crankcase heaters shall be de-energized, if the compressors will be inoperative for more than 24-hours.

- (c) Package chiller manufacturer shall indicate on his shop drawings that the sequence of operation specified herein conforms, in general, with his recommended operating procedure.
- (d) Contractor for Heating and Ventilating shall provide and install all wiring, relays, contactors, accessories, etc., required to permit the control systems to function as specified. Wiring, conduit, etc. shall be installed in accordance with the N.Y.C. Electrical Code. Submit shop drawings of control systems for approval.

15B-23.08. Operating Instructions

Provide and install where directed in the Equipment Room in the vicinity of the chillers, an engraved instruction plate with ¼-inch (minimum size) letters. Plate shall be 1/8-inch thick white core plastic laminate with beveled edge. It shall be secured to wall with "Miracle Adhesive", or equal. Instruction plate shall bear a legend recommended by the package chiller manufacturer, similar to the following:

OPERATION OF REFRIGERATION SYSTEM

Starting:

1. Energize crankcase heaters 24 hours before starting any refrigeration equipment.
2. Start one chilled water circulating pump.

15B-23.08. Operating Instructions-(Cont.)

3. Select lead chiller.
4. Turn control switch of lead chiller to "ON". After 30-seconds, turn control switch of lag chiller to "ON".

Stopping:

1. Turn control switches of chillers to "OFF".
2. Stop chilled water circulating pump.
3. De-energize crankcase heaters, if chillers will be inoperative for more than 24 hours.

15B-23.09. Emergency Chiller Stop Station

Furnish and install in the location shown on the drawings, emergency Start-Stop push button stations for the compressor motors. Push button station shall consist of a maintained contact type of unit, one contact for each compressor motor, mounted in a suitable rust-proofed box. Engrave face plate: "EMERGENCY CHILLER STOP". This Contractor shall wire between the push button station and each compressor motor starter.

15B-23.10. Refrigerant Piping, Etc.

- (a) This Contractor shall provide and install all refrigerant piping required for a complete refrigeration system, with all valves, etc. necessary for satisfactory operation. Installation of system shall conform to U.S.A. Standards Association B9.1 Safety Code for Mechanical Refrigeration. Piping shall include adequate facilities for charging, draining, and purging the system.
- (b) In general, installation of piping shall conform to the requirements of appropriate paragraphs of Section 15B-8 of the specification, except as modified herein. Horizontal piping of the compressor suction and discharge lines, and of the condenser discharge lines shall be pitched a minimum of  $\frac{1}{2}$ -inch in 10-feet, in the direction of refrigerant flow. Each suction gas vertical riser shall be trapped at its evaporator with a trap as recommended by the chiller manufacturer.
- (c) Valves shall be designed for Refrigerant-22 service. Shut-off valves shall be brass packless type. Unions, flanged valves or fittings shall be provided for disconnecting equipment, controls, etc. for making repairs. Piping shall be run in



15B-23.10. Refrigerant Piping, Etc.-(Cont.)

a single layer, with each line isolated from another to prevent rubbing. Provision shall be made for expansion and contraction of piping. All piping passing through walls, partitions, etc., shall be furnished with sleeves as specified in Par. 15B-8.03. When piping passes through walls, floors, furring, etc., precaution shall be taken so that piping does not touch any part of the building, and that the piping is supported entirely by hangers in order to prevent transmission of vibration to the building. Piping passing through an exterior wall shall be provided with a watertight sleeve as detailed on the drawing.

- (d) Any additional risers or equalizer lines which may be required by the manufacturer of the package chiller for the proper functioning of the system shall be installed as part of this contract. Refrigerant piping shall be of the size recommended by the manufacturer and as approved by the Executive Director.
- (e) In the presence of a representative of the Executive Director, the refrigerant piping shall be tested before charging. Minimum test pressure shall be 300 psig for the high side and 150 psig for the low side. Pressure may be applied with Refrigerant-22, with a mixture of Refrigerant-22 and nitrogen, or with nitrogen alone. Joint shall be rechecked for leaks with full operating pressure after charging.
- (f) The refrigerant piping above the roof slab shall be supported in a galvanized sheet steel enclosure constructed in accordance with the details shown on the drawings. The cover of the enclosure shall be held in place with stainless steel sheet metal screws on 18-inch centers. The base of the enclosure shall be secured to the angle uprights with  $\frac{1}{4}$ -inch bolts, washers and nuts. Piping shall be pitched as specified in (b). Enclosure shall be painted by this Contractor in accordance with Par. 15B-21.10(b).
- (g) Hangers and supports for refrigerant piping shall be copper plated, malleable iron or carbon steel.
- (h) Each refrigerant pipe passing through the roof shall be provided with a flashing sleeve of 20-ounce copper, so constructed and installed as to allow for expansion of the pipe and at the same time to maintain the watertight integrity of the roof. Alternate method of accomplishing these results may be approved. Submit shop drawing for approval before commencing this phase of the work

15B-23.11. Electric Work

- (a) 1. The Contractor for Electric Work will provide service wiring to the starter-disconnect switch at each condenser. He will also provide blank conduits from the condensers to the control area in the Equipment Room. In addition, he will provide a disconnect switch for each chiller in this room.
2. H. & V. Contractor shall furnish and install all wiring, switches, conduit and controls, as herein specified, shown on the drawings, or necessary for a complete installation from the disconnect switches to the control panel for the refrigeration equipment. H. & V. Contractor shall also provide interlock wiring between the chillers and the circulating pumps. All wiring shall be in accordance with the N.Y.C. Electrical Code.
- (b) Conduit run exposed inside or outside the building shall be standard rigid conduit, hot dipped galvanized inside and outside. Painting of conduit shall be in accordance with paragraph 15B-21.10(b) of the Standard Specification.
- (c) Starters for the compressor motors shall be either part-winding type, the equal of Allen-Bradley Bulletin 736 or across-the-line magnetic type the equal of Allen-Bradley Bulletin 709 and shall have overload relays in each of the three phase legs. Each condenser fan motor shall be provided with a combination starter and disconnect, the equal of Allen-Bradley Bulletin 712, and shall have overload relays in each of the three phase legs. Proper size starters shall be furnished in accordance with the following table:

Maximum Motor H.P.	3	7½	15	30	50	100	150
NEMA Size	0	1	2	3	4	5	6

15B-23.12. Signs

1. Furnish and install signs, as required by the N.Y.C. Administrative Code, in accordance with the following:

Provide a sign for each refrigeration system in the Equipment Room. Sign shall be of 1/8-inch thick white core plastic laminate at least 8½x11 inches in size, with beveled edges and with ¼-inch high (minimum size) engraved letters. Sign shall be located where directed, and shall be securely fast-

15B-23.12. Signs-(Cont.)

ened to the wall with screws and screw anchors. Sign shall list the following information:

- (a) Name and address of installer.
- (b) Horsepower of prime mover or compressor.
- (c) Kind and total number of pounds of refrigerant in system.
- (d) Refrigeration leak field test pressure applied.

2. Post emergency instruction sign in the Equipment Room for systems over 15 horsepower, as near as is practicable to the refrigerant compressor, giving instructions for the operation of the system. Sign shall be of plastic laminate as specified in No. 1 above. The operating instructions shall include the following precautions:

- (a) Instructions for shutting down the system in case of emergency.
- (b) Name, address, day and night telephone number for obtaining service. (This information shall be printed on heavy paper stock and secured to the plastic sign with pressure sensitive adhesive).
- (c) Telephone number of the Fire Department, and instructions to notify said Department immediately in case of emergency.
- (d) Instructions shall state that in case of emergency or refrigerant leakage: the Equipment Room shall be vacated promptly, the system shall be shut down by means of the required remote controls located outside the Equipment Room and the room shall be ventilated.

NOTE: Where such systems are roof mounted or roof suspended, sign shall be posted at control switch. If unit is remote from said switch, an additional sign (protected from the weather) shall be posted on the unit.

3. Provide metal signs having  $\frac{1}{2}$ -inch high (minimum size) letters for refrigeration systems 25 horsepower and over, designating the following:

- (a) Main stop valves to each vessel.
- (b) Main electrical control.
- (c) Remote control switch.
- (d) Pressure limiting device.
- (e) On all exposed high pressure and low pressure piping outside of Equipment Room, signs giving the name of refrigerant and the letters "HP" or "LP".

15B-23.12. Signs-(Cont.)

4. Provide dated declaration of test for erected refrigeration systems over 15 horsepower. Declaration shall be protected by glass, mounted in a metal frame and shall be posted where directed in the Equipment Room. It shall contain the following information:
  - (a) Name of refrigerant.
  - (b) Field refrigerant leak test pressure applied to high side and low side of system.
  - (c) Signature of installer.
5. Provide metal signs having  $\frac{1}{2}$ -inch high (minimum size) letters identifying stop valves at the following locations:
  - (a) Each inlet of each compressor, compressor unit or condensing unit.
  - (b) Each discharge outlet of each compressor, compressor unit or condensing unit, and of each liquid receiver.
  - (c) For all systems containing 100-pounds or more of a refrigerant, on each inlet of each liquid receiver and each branch liquid and suction line, except that none shall be required on the inlet of a receiver in a condensing unit nor on the inlet of a receiver which is an integral part of a condenser.
6. Provide a label for emergency remote control for compressor, located outside of Equipment Room. Label shall be of 1/8-inch thick white core plastic laminate with beveled edges and with  $\frac{1}{4}$ -inch high (minimum size) letters.
7. Provide label for emergency remote control for mechanical ventilation, located outside of Equipment Room. Label shall be of 1/8-inch thick white core plastic laminate with beveled edges and with  $\frac{1}{4}$ -inch high (minimum size) letters.
8. Provide metal or laminated plastic nameplates for separately sold condensing units and compressor units sold for field assembly with the following information:
  - (a) Manufacturer's name.
  - (b) Nationally registered trademark or trade name.
  - (c) Identification number.
  - (d) Horsepower of prime mover or compressor.
  - (e) Name of refrigerant for which system is designed.

SECTION 15B-24  
MISCELLANEOUS EQUIPMENT

15B-24.00. Chain

The chain used to operate dampers, safety valves, etc. shall be hot galvanized or sherardized steel sash chain, having a tensile strength of not less than 500-pounds. Pulleys used in a chain installation shall be at least 2-inches in diameter, and shall be swivel type, of heavy duty construction. Each chain installation shall have a stop-link to prevent overtravel when unhooked, and shall have a 2-inch diameter ring of 1/4-inch steel secured at the end of the chain.

15B-24.01. Installation of Electric Refrigerators

In schools having Home Economics (Food) Class Rooms and/or Science Project Prep Rooms, residential type electric refrigerators will be delivered to the site by others. HVAC Contractor shall uncrate the refrigerators and install one in each of the above rooms, where directed. Each refrigerator shall be plugged into the electric outlet provided by others, and shall be left in working order.

END OF SPECIFICATION

Dated, The City of New York

June 1981

J. T. Sheehan

ANTHONY R. SMITH  
Executive Director  
Division of School  
Buildings  
Office of Engineering  
Support Services  
Board of Education

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