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Construction and Landscape Check List

Federal Public Housing Authority - National Housing Agency

FOR
FIELD FORCES PERFORMING INSPECTION OF
CONSTRUCTION WORK

PART I

CONSTRUCTION CHECK LIST

1. GENERAL.

a. The attention of construction advisers and project managers is directed to the following list of items, which previous experience has emphasized for special attention in connection with the supervision of field inspection of housing projects. The construction advisers and project managers are presumed to be acquainted, from past experience, with the subjects discussed.

b. This check list will serve as a reminder of conditions to be watched for and guarded against. It is not intended to be a criticism of the requirements of specifications now in effect unless construction should result which would be detrimental to the interests of the project, in which case, the question should be made the subject of a conference with representatives of the regional office and a solution obtained if possible.

c. It is not presumed that each and every item or quality of workmanship and material which should be watched is included but the more important items encountered on the housing program have been scheduled.

d. It cannot be too strongly stated that aside from the fact that any construction contract should be enforced, the public reaction against failures of any nature on even a few of our projects will be capitalized by opponents of the program, and that any justifiable grounds for a belief that we are condoning, or ignoring, improper work by the contractors would work serious injury even though the blame might rest on the local authority where a local authority exists and functions. This does not mean to say that contract enforcement should be unduly severe. Every effort should be made to apply rules of common sense judgment in passing on the quality of materials and workmanship. This cannot be reduced to a formula but involves a wide background of practical experience on the part of those who render decisions and the painstaking and impartial examination of every issue that arises.

e. Federal, State and City specifications are frequently referred to in the contract specifications in a qualifying capacity. Copies of all referenced specifications should be on file and available to all inspectors concerned.

f. National, State, City, Technical Society, and Laboratory Codes, pertaining to various structural and mechanical trade requirements, are also sometimes referred to in the contract specifications, and for the same reason should be likewise filed for availability.

g. If the contractor's field organization on a large project does not include a coordinating mechanical engineer, discuss with the contractor the desirability of a technician being appointed by the contractor to supervise the mechanical work and its coordination with other trades to avoid conflicts in underground elevations, duplication of space assignments in building roughing-in work, and other incidental details which are constant sources of delay and expense. The services of a coordinating mechanical engineer and his properly coordinated layout drawings, have, from experience, definitely proven their value on large projects. This is a suggestion and should not be proposed as an extra service which may result in a claim by the contractor for additional compensation.

h. Early and expeditious approval of materials, shop drawings and samples and receipt of required laboratory test reports, enabling the release of materials in ample time for incorporation in construction, will be worth all extra effort expended. The Construction Adviser or Project Manager should watch this carefully.

i. Shortly before each separate trade begins work on the project, the Construction Adviser or Project Manager should read very carefully the appropriate comments contained herein with reference to that trade. At the same time, a very detailed study should be made of the specification requirements for that particular trade in order that the Construction Adviser or Project Manager may be kept up to the moment concerning exact contract requirements. This will avoid some of the consequences of forgetfulness should the specification be read at the beginning of the project and not referred to again during the completion of the work.

2. TEMPORARY HEAT.

a. It is imperative that proper temperature be maintained throughout the interior of all buildings at least from the time plastering begins until completion of the painting and decorating and beyond if required by conditions or by the contract. During the period of plastering, heat should be maintained if conditions warrant in a manner to dry out the buildings to prevent freezing or frosting or plastering and reduce dampness to a minimum.

b. The installation of interior wood work and interior painting of wood, plaster or other materials requiring dryness for proper reception of paint, must not be permitted until the materials to be painted are thoroughly dry. In connection with any work other than that mentioned above which might require temporary heat for its proper performance or preservation, heat should be supplied as circumstances demand.

c. The condition with reference to proper heat should be checked carefully and in case results are not obtained and maintained, the matter should be reported to the Regional Office of the FHA.

3. EXISTING TREES.

a. It is important that attention be given to the preservation of any trees existing on the site and designated to be saved. Protective boxing to save the trunks from being skinned or bruised should be erected prior to any activity of demolition, trucking or grading. The root system within the area of the spread of the branches should also be protected from trucking, trampling or storage of building materials or debris. Fires should not be permitted under the overhanging branches.

b. Inasmuch as utility layouts are usually diagrammatic, pipe or conduit lines are frequently indicated through or under existing trees. With reasonable foresight, these lines can usually be so adjusted as to remove all danger of cutting important roots or otherwise disturbing the existing food or water supply of the trees.

c. In grading around existing trees, it is frequently observed that the grading contractors disregard definite instructions in the specification concerning the disturbance of soil within the spread of the branches. Many valuable and decorative trees have been destroyed because roots have been unnecessarily cut by grading operations to within a few feet of the tree trunk. When elevations of trees are above new finished grade, the existing elevation shall be retained as far from the trunk of the tree as possible with the difference of elevation taken up in a long slope. Where existing elevations of trees are below the new finished grade, check should be made to see that the specified operations are followed.

d. Feeding and spraying of existing trees, if specified, should be undertaken at as early a date as possible in order to overcome the loss of vitality due to necessary grading or excavating activities. If not originally specified, attention is directed to the fact that the

value of these trees to the project may be greatly increased by a judicious and comparatively inexpensive treatment of the proper kind. Consideration might, therefore, be given to a change to have this work done by the contractor under direction of the professional consultant.

4. DEMOLITION.

a. Remove all work to the grades and elevations specified.

b. Clean debris from basements if specified.

c. Leave site in orderly condition after all demolition is completed.

d. All utility lines and services should be left in specified condition.

e. Remove all stored, salvaged materials.

f. See that walks and curbs which are to remain are left in good condition.

5. EXCAVATION, BACKFILL AND GRADING.

a. Possibility on sites reclaimed by demolition of deeply located cisterns and cesspools not being cleaned out and filled, and of water, sewer and gas service lines not being properly stubbed and plugged.

b. Tendency of laborers to refill footing areas excavated too deeply.

c. Constant tendency of all contractors to dump rubbish adjacent to foundation walls instead of clean, compacted fill creating leakage hazards around basement walls.

d. Use of automotive equipment to backfill around foundation walls without tamping to compact fill allows formation of water pockets next to wall.

e. Fill for planting and lawn areas to be checked carefully for debris.

6. PILING.

a. Penetration. Should be recorded.

b. Test of load-bearing. Should be recorded.

c. Elevation of cut-off. Should be recorded.

d. Record of the driving. Should be recorded.

e. Location of ground water level. Should be recorded.

f. Obtain certificate of treatment of wood piles if specified.

7. STREET AND YARD IMPROVEMENT.

a. Verify quality of materials to be incorporated in the work.

b. Check drainage of all paved areas, in order that storm water will be carried to the catch basins in these areas.

c. Yard subgrading, preparatory to topsoil fill and finish grading by landscape contractor, causes considerable difficulty. Grades through use of automotive equipment, with insufficient hand dressing are inaccurate and uneven. Heavily filled areas generally are low through failure to allow surplus for eventual settlement or machine compacting. Constant occurrence of too much building rubbish in the final subgrade can be eliminated by insisting on periodic cleanups and removal from site of accumulated rubbish.

d. In yard subgrading with automotive equipment much steam and electric conduit is damaged. Marking these trench lines during grading to avoid crossing them with automotive equipment will prevent subsequent necessity for expensive replacement.

e. Concrete walks, curbs and streets poured without proper ground preparation, on untamped earth or cinder fill, without proper protection for emergency showers or frost and indifferent compliance with specified curing methods result in too much replacement. Indicated expansion joints are frequently omitted; required slab thicknesses are provided at the form contacts but skinned between forms, and finished surfaces are too carelessly floated or troweled, resulting in eventual corrective work or replacement. Indifferent compacting of trench fill over which streets and walks are laid causes settlement and expensive replacement.

f. Insufficient rolling of subgrade and applied surfacing of bituminous streets, parking and play areas causes difficult correction and expensive maintenance. The tendency of subcontractors, for this work, to drive over walks with heavy equipment and material trucks, without properly bridging the walks, damages many slabs unnecessarily.

g. Provide adequate protection for all finished walks, play areas and pavements.

h. See that there is a proper fall in the area to be drained by rain water inlets.

i. Frequently grade elevation marks of concrete walks, etc., are carelessly set. Check should be made of elevations when form work is installed to avoid pouring concrete in faulty forms. Where it is plainly evident that a possible error has been made in indicating interpolated elevations on grading plans, work should not proceed until determination is made by Site Engineer as to correctness of such.

j. Read specification requirements very carefully in connection with street and yard improvements and make continuous check as work is installed. Be especially diligent in connection with macadam pavements and all bituminous work.

8. FOUNDATIONS.

a. Pouring of footings, particularly in clay soils, after rain without removing the churned-up mud to assure uniform bearing.

b. Note the tendency of laborers to dump concrete in spots, instead of circulating in dumping slowly around wall forms.

c. Window frames set in forms generally have pockets under sills due to failure of laborers to puddle grout under frames. Door frames set in forms frequently have jambs bowed because improperly braced.

9. CONCRETE WORK.

a. Frequent slump tests should be made of all concrete to insure proper water-cement ratio for development of specified strengths with approved mix.

b. Periodic check of concrete aggregate should be made by sieve analysis to obtain specified fineness moduli of materials.

c. Periodic check should be made on batch mixing time; tendency is to shorten specified time of mix.

d. General difficulty to obtain curing and protective methods specified.

e. Necessity for level and proper finish of slabs for structural covering by other floor materials, is often too lightly regarded. Accurate placing of sufficient screeds will materially assist in producing level finish.

f. Compare all accessories with approved samples.

-O. BRICK AND TILE WORK.

a. It is imperative in all brickwork and backup of exterior walls that all bed, cross and vertical joints be completely filled, and that pargeting, when specified, be applied as specified. Laxity in the fundamentals of full joints is a practical assurance of wall leaks.

b. Waterproofing, when indicated, of either membrane or metallic material, should be applied in accordance with details and specifications, unless approval of changes is obtained.

c. Spandrel masonry and waterproofing should be given particular attention to obtain exacting construction and resultant imperviousness to moisture.

d. Special attention should be given to quality of pent house construction and waterproofing to insure tightness.

e. Point all line nail and other holes as work progresses, then they will not be overlooked to contribute to future leaks.

f. Whatever backup is used, emphasize the necessity for definite bonding and full mortar joints.

g. Insufficient care taken in selecting common brick used for exterior wall faces. Too many cracked and spalled brick invite wall leaks.

h. Necessity for special care in laying up parapet and fire walls to insure full tight mortar joints and tight bond of wall flashings into wall. Make recheck after roofers have turned counter flashing back over wall flashing to see that counter flashing joint is repointed and weather tight.

i. Clean masonry refuse out of buildings before it sets hard and also permanently discolors finished concrete floors, particularly closet floors.

j. Be positive that fire brick meet specification requirements before allowing their incorporation in incinerators.

k. Tendency of window and door angle lintels to project beyond face of wall; jamb joints often poorly spaced so that lintels rest on too thick a mortar bed; bed joints of brick resting on lintel usually poor, requiring caulking later.

l. In winter masonry work, constant care to have properly heated materials and protection will avoid frozen joints and other expensive corrections.

m. In incinerator construction, imperative that all joints are full and all fittings tightly masonried in to avoid gas and smoke leakage and fire hazard.

n. Anchors for radiator hangers and sundry iron work built in solidly.

o. Salt glazed brick and tile to be checked for tolerances in size and shape allowed by the specifications. The completed work should be protected, particularly corners, and should be properly cleaned and pointed.

p. Partition tile should have full mortar beds; no cracked, warped, or tile with large spalls should be permitted; tile walls not plastered should be cleaned. Bucks and frames built into partitions should be well anchored and the tile filled in solidly around the bucks and frames.

11. CUT STONE WORK.

a. Check for spalls (watch for objectionable Dugan patches).

b. All sills and projections should be protected.

c. Do not allow the use of acid in cleaning. If acid cleaning materials are used on other parts of the work, stone must be protected.

d. Check to see that all wedges are removed and holes pointed when stone is being cleaned.

e. Coping stone is often set without expansion joints causing movement of stone, loosening of bond and opening of joints.

f. Observe the tendency to skimp oakum packing and mastic fills of coping joints.

12. CHIMNEYS (CENTRAL POWER PLANTS).

a. Be sure fire brick meet requirements and that mortar is specification mix.

b. Check Chimney periodically during construction, with transit, to assure plumbness and taper.

c. Check masonry to assure full mortar joints, and the inclusion of no cracked radial brick.

d. Keep air space between fire brick and radial brick clean.

e. Be sure steel reinforcement bands are placed at proper intervals, and that iron work is built in solidly and the exposed parts painted.

f. Lightning conductor, properly grounded, should be placed on chimney immediately upon its completion.

13. INCINERATORS.

a. Check materials and installation with shop drawings.

b. Check grate area.

c. Verify proper keying of arches over firing doors.

14. DAMPPROOFING, WATERPROOFING AND CAULKING.

a. General tendency to skimp on material and to cut back asphalt for spraying below the specified asphalt content.

b. Attempts made to substitute one coat for the two specified.

c. Careless protection of adjacent work causes expensive cleaning, particularly where walls are sprayed, and the finished concrete floors and ceilings are adjacent.

d. Membrane waterproofing requires exacting inspection for proper installation. Skimping on asphaltic material, narrowing of membrane widths, failure to turn up edges, has caused damaging leaks and expensive replacement.

e. Application of too much asphalt on spandrel flashings over lintels causes oozing of material and staining of window or door members.

f. Note tendency when wide or deep cracks occur at joint returns, to leave out oakum packing and just apply caulking compound.

g. Waterproofing, when indicated, of either membrane or metallic material must be applied in accordance with details and specifications to be effective.

h. Spandrel masonry and waterproofing should be given particular attention to obtain exacting construction and resultant imperviousness to moisture.

i. Special attention should be given to pent house construction and waterproofing to insure tightness.

b. Check frames for warp or twist; erected plumb; be well braced.

c. Metal trim and stools should be fully bedded with mortar. Rigid inspection is necessary to obtain this result. Many head and side jambs are bowed by careless mortar fill.

d. Before installation of sash or metal trim, be sure prime coat is satisfactory for final paint finish, so that "lace curtain", "orange peel", or "alligator hide" finish does not result.

e. Be sure screens are bronze wire and not copper-plated metal, and tight in the frame.

f. Have friction hinges in proper adjustment, particularly after glazing, to prevent windows slamming in sudden winds.

g. If possible, drill metal jambs for curtain mountings before final plastering and painting is done.

18. METAL BUCKS.

a. Compare with approved sample as to gauge of metal and character of welding specified, and check with approved shop drawing.

b. General tendency to insecurely anchor metal bucks and to brace properly during erection of partitions, so that bucks are loose, out of square and plumb; expensive to correct later.

c. Bucks on main travel lanes in buildings, if protected, would prevent a great amount of damage.

19. HOLLOW METAL DOORS.

a. Check for the specified number of coats of paint.

b. Doors should be hung with uniform clearance, reasonable space between bottom of door and threshold, and operate freely.

c. Check application and operation of hardware.

d. Hanging of hollow metal doors should be delayed as long as possible to prevent careless damage.

20. METAL STAIRS.

a. Check fabrication to insure tight fit of risers and treads at skirting stringers to prevent dirt from filtering through.

b. Check erection for anchorage of stringers, tread levels, for welded, bolted, or riveted connections, platform and stair stringers to fit tight against adjoining walls.

c. Check shop coat of paint.

d. Board fillers in stair pans prior to concrete fill will protect nosings from unnecessary damage.

21. METAL TOILET PARTITIONS.

a. Check prime coating applied at shop.

b. Check erection for solid anchorage into masonry.

c. Check hardware for application and operation; doors should be fitted to operate freely.

22. MISCELLANEOUS IRON.

a. Wall rail brackets should be solidly anchored.

b. Wire mesh partitions should be solidly anchored.

c. Check depth of letter boxes with thickness of wall.

d. Check for field coat by this contractor and by painting contractor.

e. Pipe rail posts should be properly caulked into sleeves.

23. PLASTERING.

a. Check materials. Old, gauging plaster will cause defective putty coat which may not be immediately apparent.

b. Sand varies in different localities, and specified mix may need slight variation, but over-sanding, a common tendency, must not be permitted.

c. Be sure rooms and surfaces are of proper temperature, and that rooms are properly ventilated. Frozen or "burned" plaster can be avoided.

d. One method of insuring that hollow metal bucks will be solidly filled is to slush them full when applying the scratch coat.

e. Check cornerites where specified.

f. Check solid plaster partitions as to alignment, anchorage, and thickness specified.

g. Covering finished concrete floors while plastering will prevent stains which cannot be removed later.

h. Laborers following up plasterers and immediately removing damp smears on metal bucks, sash and trim, will save costly later cleaning.

i. Remove debris from site. Tendency is to shovel it out the windows and bury it next to the building wall.

j. Be sure bath tubs are properly protected before plastering is started in bathrooms.

k. Check plaster frequently for proper thickness, and for the practice of substituting 2-coat for 3-coat work.

24. CARPENTRY AND MILLWORK.

a. Establish definitely that all materials are of specified grade.

b. In wood joist construction, be sure joists are straightened before applying floor lining, and that all bridging is nailed before applying lath.

c. On wood hip roofs, check rafter pattern to see that head and toe of miter cuts fit, and that all rafters are straightened before sheathing is applied.

d. Be sure that all double studs, headers, and blocking required are securely in place prior to lathing.

e. In wood framed buildings be sure skeleton is plumb, square, and properly braced before sheathing is applied.

f. Exterior door frames should be solidly anchored.

g. Doors hung with uniform clearance at head and jambs.

h. Kitchen cabinets should be solidly anchored.

i. Cabinet mouldings scribed to ceiling and wall.

j. Ironing boards should be solid.

k. Thresholds full length and width solidly fastened.

l. Sash should operate freely.

m. Work table drawers and bread board to operate freely.

n. Check cabinet and work table doors for warp and checks.

25. ASPHALT TILE FLOORS.

a. Compare with approved samples.

b. Check for cracked or damaged tile.

c. Check for cleaning and any protective coating.

d. Check for complete adhesion.

26. GLAZING.

a. Check putty application for adhesion, putty should be painted after surface has oxidized, but before it has started to crack.

b. Where back and bed puttying are indicated, special effort is usually required to get it.

c. Be sure glaziers are skilled in beveling putty; mass production produces unsatisfactory work requiring later correction.

27. PAINTING.

a. Painting difficulties have been largely workmanship and carelessness. Precaution can be taken to prevent smearing and splattering all other finish work. Cleaning up after painters is one of the largest punch list items.

b. Surfaces must be dry and temperatures as specified; the tendency of contractors to rush work, in violation of these conditions, only produces work to be corrected later.

c. "Lace curtains" and "runs" are common faults occasioned by too thick application of material or insufficient brushing.

d. Tendency is to skip painting back side of pipes, back and bottom of radiators, tops and bottoms of doors, under surfaces of window stools, chair and book strips and return of metal buck and window trim. Painting of top and bottom of doors is very important and should be insisted on where specified and brought to the attention of Regional Director if not specified.

e. Tendency is to skip final coat in all phases of work in an attempt to have prime and first coat suffice.

f. Tendency is to omit puttying nail holes and other imperfections or to properly clean and sand work prior to painting.

g. See that all surfaces to receive paint are thoroughly cleaned of all stains from other materials such as dampproofing, caulking compound, plaster, etc.

h. Test all paint and all painters' materials for full compliance with contract requirements. This is most important and should never be overlooked. Consult Regional Office at once if trouble is encountered in having this done.

28. WEATHER STRIPPING.

a. Compare materials with approved samples, and check for gauge of metal, etc.

b. Tendency is to space nails farther apart than specified, and to install strips without necessary refitting of windows and doors.

c. Thresholds are often installed without being filled with specified caulking compound.

29. HARDWARE.

a. Compare with approved samples.

b. Check clearance of door closers.

c. Check action of all locks and fitting of keys.

30. PLUMBING (INSIDE THE BUILDING).

a. Verify proper slope in all drainage lines.

b. See that cleanouts are installed where called for in the Specifications or in the Local Plumbing Ordinance and that they are accessible.

c. See that all soil, waste and vent stacks and water risers have proper support as required by the Specification and Code.

d. The specified spacing and design of all single and trapeze hangers on all pipe lines in basements or pipe spaces should be verified.

e. See that all piping is properly tested as required by Specification and Code requirements and in presence of City Inspector, when so required.

f. Check adequacy of all hot water generator supports, accessibility of coils and accessories for removal and service and visibility of all instruments and gauges.

g. All screwed pipe should be properly reamed.

h. Unless otherwise specified or required by Local Code, oakum and cement joints should be provided for all terra cotta or tile pipe.

Wherever possible, it is advisable that provision be made to maintain the water seal in all floor drain and shower traps.

j. Precautions should be taken to insure that all water piping pitches so that the lines can be readily drained and so that danger from freezing will be avoided.

k. To prevent joints from blowing out, it is advisable that building main piping be securely anchored adjacent to any connection with cast iron service piping.

l. When stop and waste valves are not specified for sill cock or hose bibb lines which might be subjected to damage from freezing, they should be provided with some other positive means of shut-off and drainage.

m. Instruments should be located on all apparatus so that dials are entirely visible.

n. To avoid damage from dirt and grit to the moving parts of pressure reducing valves, pumps, etc., the installation of strainers on the inlet side of such equipment is essential. When specified, the actual installation of strainers with adjacent shut-off valves should be verified.

o. Precautions should be taken to prevent damage to pipe covering due to moisture and dampness. A continuous circulation of air in spaces where this work is progressing is essential and the application of the first coat of any specified sizing or paint as soon as the covering is dry will act to prevent mildew and disintegration.

p. To prevent water hammer and the accumulation of air in water piping, the installation of air chambers at the tops of risers and particularly those serving fixtures with self-closing faucets or flush valves is desirable. When specified, the actual installation of air chambers should be verified.

q. The use of long sweep fittings at changes in direction of drainage piping, in preference to the cheaper short turn fittings, is desirable for facility in maintenance and is often a Code requirement. When specified or required by Code, the actual use of this type of fitting should be carefully verified and precautions should be taken to avoid the unauthorized use of short turn fittings.

r. It is advisable that the accumulation of rust on inserts, hangers, etc., be prevented by the application of paint or rust resisting preparation. When specified, this

material should be applied as soon as possible after the removal of forms. Such a coating should preferably be applied by dipping.

s. In cases where genuine wrought iron pipe is specified, the approved material should be carefully noted and the presence of such distinguishing marks as the manufacturer's name, knurling and spiral bands peculiar only to that type of pipe should be verified in order to prevent the use of inferior materials which sometimes have a similar appearance to a casual observer.

t. Since there is a wide variation in price between various grades of valves of the same type and between such classifications of fittings as standard cast iron, recessed drainage and malleable iron, similar careful observation of these materials is essential to detect non-compliances. Particular attention should be given to the pressure markings which invariably appear on valve bodies to determine that the Steam Working Pressure (S.W.P.) or Water Working Pressure (W.W.P.) for which the valve is designed agrees with specification requirements.

u. Similar observations should be made of cast iron soil pipe and fittings and of the weight markings appearing thereon, particularly in localities where light weight, medium weight or "standard" pipe is available.

v. Kitchen and Lavatory Equipment

(1) Kitchen Ranges - Gas, Coal or Oil fired.

See that they are clean, and that porcelain trimmings are not chipped or broken.

(2) Space Heaters.

See that both the heater and heating element are clean, and finish is not damaged.

(3) Water Heaters - Gas and Oil fired.

If encased in a finish shell, see that the shell and finish are undamaged.

(4) Tests for 1, 2, and 3 above.

See that the Contractor, or Manufacturer's Representative, as may be required in the specifications, demonstrates the equipment to be operable after installation and that it will meet the specification requirements, and proper draft obtained.

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(5) See that vents and smoke pipes are not obstructed, and that proper collars, thimbles, draft diverters, ect., as specified are installed.

(6) Plumbing Fixtures.

(a) See than sink legs are tight.
(b) See that faucets operate easily, that "H" is on left and "C" on right, and that when shut off, the handles are in similar positions.
(c) See that chains and plugs are installed or delivered to proper person.
(d) See that water tanks, sinks, and lavatories are level.
(e) See that bath tubs resting on finished concrete floors have the open joint between the tub apron and floor sealed.
(f) See that nozzles over bath tubs cannot be pulled away from wall.
(g) Where transfer valves are used, see that when water is running in tub it is not also running in lavatory, and vice versa.
(h) See that water closets sit tight to floor or that joint is grouted with white cement or plaster of paris; that China bolt caps, if specified, are installed and properly cemented in place; that where chrome-plated nuts and washers are used, the washer covers the slotted hole in the base of the closet; and that where four bolts are used, the front two bolts are properly imbedded in the floor.
(i) See that water closet flushometer valve in tanks operate properly; and that adjustments in flush connections are made so that escutcheons on tail pieces fit snugly.
(j) Fill fixtures to see if water runs off promptly. Clean traps and use force pump where necessary.
(k) See that wall hung fixtures are securely installed, particularly on lath and plaster partitions.
(l) See that there are no leaks at faucets, stuffing boxes, ground joints of sink swivels, connections and clean out plugs under fixtures, and around walls to which fixtures are attached. Damp spots on walls or a baseboard may be due to nails penetrating concealed copper piping.
(m) See that all fixtures are clean, free from dirt and paint; and that in cleaning fixtures no damage is done to the finished surface. It is suggested that in cleaning paint or other hard set substances from fixtures, do not permit the use of steel wool, metal scrapers or safety

razor blades. Some solvent, such as turpentine or benzine, can be used for paint; kerosene can be used for the removal of black scratches and is effective without damage to the finish. For general cleaning, use soft tissue paper or cheese cloth and a soft smooth cleaning compound.

(n) See that fixtures are not defective or damaged. If practical, they should be checked before installation as well as after they are in place and cleaned. The following list of possible defects with causes, means of identification, and, in parenthesis, whether such a defect is cause for rejection.

i. Chips - Are caused by rough handling. (cause for rejection)

ii. Lifts Are the result of one of two things - First, by a heavy blow or dropping, easily detected by the many cracks or crazes radiating from the defect. Second, a poor bond between the metal and the slush coat, recognized by the porcelain coming off without showing cracks or crazes around the edges. (cause for rejection)

iii. Crazes - Are a number of small cracks sometimes showing rust through them. (cause for rejection)

iv. Pin Holes - Are a black speck running thru the porcelain to the metal. (cause for rejection)

v. Specks - Are manufacturer's defects but can hardly be prevented in the process of manufacture as they are specks of carbon that light on the enameled surface before it has had time to cool.

Small specks visible at 2'0" from fixture up to 1.64". (More than 8 in a 3" diam. circle is cause for rejection.)

Medium specks visible at 4'0" from fixture 1/64" to 1/32". (More than 4 in a 3" diam. circle is cause for rejection.)

Large specks visible above 4'0" from fixture 1/32" to 1/8". (cause for rejection

vi. Dimples - Are a slight depression in enameled surface. (More than 2 visible inside a 3" circle is cause for rejection.)

vii. Scratches - Are usually caused by poor protection during construction and are more prevalent on the rims of bath tubs due to

mechanics standing on them. (The injury caused by the individual cracks will determine whether it is cause for rejection.)

viii. Warpage - A tolerance of 1/32" per foot is allowed on the edges in contact with walls and 1/16" per foot on other edges.

ix. Blue Surface - Is the result of insufficient thickness of porcelain. (If not too pronounced may be accepted.)

x. Acid Stains - Are caused by strong acids used by tile setters or other workmen. Such stains usually destroy the surface. (The injury caused by the individual stains will determine whether it is cause for rejection.

(7) See that temporary caps are installed on all open ends of pipe.

(8) See that circulating lines between ranges and boilers are straight and parallel.

(9) See that escutcheons, if specified, are installed on all pipe in finished rooms.

(10) See that sill cocks are securely fastened to walls.

(11) In crawl spaces see that nails fastening inserts to forms are clipped off and that all rubbish is removed.

(12) See that gas lines drain back to main or drip pocket.

31. PLUMBING (OUTSIDE THE BUILDING).

a. Strict compliance with all codes and utility company regulations covering tests, minimum slopes, standard valves, shut-off boxes and other accessories should be observed and precautions should be taken to avoid damage to all such piping and accessories which might be caused by heavy machinery or trucks passing over the filled trenches. Similar and more extensive precautions should be taken to avoid any such damage to tile pipe or conduit.

b. It should be observed that all piping laid in filled ground has proper support to maintain its alignment. The protection of materials installed in soil of a corrosive nature should also be encouraged.

c. Careful attention should be given to the compliance with code regulations governing the minimum distance from windows and vent pipe openings above the roof.

d. See that top of box for curb stops is level with sod or sidewalk as installed.

e. See that storm water sewers and inlets are free of mud and sand.

32. PLUMBING (GENERAL).

a. It is most important that compliance with all codes and ordinances regulating smoke or peppermint tests be observed after completion of the entire plumbing systems to ascertain that trap seals have not been broken, that the drainage and vent systems contain no leaks and that plumbing fixtures contain no defects in fabrication.

b. The preparation of Co-Ordination Drawings or Working Drawings by the Mechanical Contractors or Subcontractors before installation of any work, particularly in congested areas, should be encouraged to insure maximum head room proper pitch and alignment of piping and to avoid interferences of any nature.

c. The Construction Adviser or Project Manager should see that plumbing fixtures, particularly tubs, are properly boarded, or otherwise guarded during the construction period.

33. ELECTRICAL INTERIOR SYSTEMS.

a. The specifications and local codes usually require that all materials and equipment be labelled by the National Board of Fire Underwriters as approved for the specific purpose for which they are used. Reference may be had to the "Underwriters' Laboratories, Inc., List of Inspected Electrical Equipment." Generally, the requirements of the National Electrical Code should be met, as well as those of any other applicable Codes or Regulations. This, however, does not permit the elimination of any labor or materials required by the drawings or specifications. Outdoor construction should meet the requirements of the National Electrical Safety Code. Certificates of Approval should be secured from the recognized inspection authority having jurisdiction, and their approval should be obtained before concealing any portion of the work.

b. Job conditions are certain to arise which will demand a rearrangement of equipment to meet field conditions necessitating the rerouting of conduit runs or changing the location of service entrance switches, distribution panels, pull boxes, etc. In approving such changes as outlined above, and in the absence of advice from the Architect, approvals should always be given with the limitations that there will be no change from the intent of plans and specifications; no change in contract time or price; no change or substitutuion unless it is clearly to the benefit of the Authority.

Electrical drawings are generally diagrammatic, and the exact routing of raceways, location of outlets and equipment should be governed by structural conditions and obstructions. This should not be construed to permit redesigning systems; all outlets should be interconnected as shown on drawings unless specification permits otherwise. Where changes are found to be necessary or desirable, see that proper authority is established before the work involved is started.

Specification requirements should be checked for outlet box, fitting, conduit, wire, fuse and fixture requirements at the beginning of the construction. Suitable conduits should be provided for installing the necessary ground wires in each building. Connection should be made in an accessible location to the cold water pipe, by means of approved clamps and fittings, and the grounding conductor should run to the service switch cabinet, for connection to the system and equipment.

Consult architectural and mechanical detail drawings for exact location of kitchen equipment, machine room equipment, heating plant layout, etc., so that electrical work will be roughed-in at the proper locations.

c. Materials and Methods

(1) Ascertain that all outlet boxes are the type and size specified or required by the Code. Check conduit runs for sizes indicated on the plans before slabs are poured, or walls, floors and partitions are constructed. Conduits crossing expansion joints in slab construction should be provided with adequate means for expansion. Approved fittings are available for this purpose. Over unexcavated areas, conduits should not be trapped (due to condensation which will occur) unless drain outlets are installed at the lowest elevation or unless lead-covered or moisture-resisting wire is installed.

(2) Where outlets are installed in 2-inch partitions, boxes having a depth of 1¼-inch with ¼-inch raised covers should be installed to permit the proper application of plaster behind the outlet boxes.

(3) All boxes should be installed plumb and level. Outlet boxes extending beyond the finished surface should be brought back flush or not over ¼-inch inside the finish plaster line.

(4) Consult the electric code for proper gauge and size of junction and pull boxes for given conditions.

(5) Conduit ends should be plugged during construction to prevent the entrance of moisture and dirt. Conduits that are found to contain water should be thoroughly swabbed before installing wires.

(6) In concrete construction, all re-cut or new thread-on conduit to be installed in slabs should be red-leaded. Flat bends in conduit or thin wall tubing should be rejected.

(7) Exposed conduit runs should be installed parallel with or at right angles to the lines of the building.

(8) The gauge and insulation of all wires and cables should be closely observed during installation for compliance with the type and sizes specified or indicated.

(9) At distribution centers, meter centers, power and light panels, the loads should be balanced across the various phases. The contractor should be encouraged to use color-coded feeder and sub-feeder cables (if not a contract requirement) and the same sequence of colors for the phase wires used throughout the systems.

(10) As switches, receptacles and panels are installed, it should be observed that the systems are properly polarized, i.e., the white or otherwise indentified grounded conductor should be continuous from the service switch to panel boards and thence to all light and receptable outlets without breaking through a switch or switches. Switches and receptacles should be so installed as not to depend on the plates to hold them vertical or horizontal. All plates should be installed plumb and should not be dished or bowed by being pulled too tight or forced over a device not set flush with the finished surface.

d. Tests - The following tests should be performed by the local Inspector and witnessed by the FHA Representative:

(1) Insulation resistance tests should be made of the wiring system in each building with a "Megger" at the service entrance switch. These tests should be conducted before lamps, meters, clocks or other circuit closing devices are installed. The neutral conductor should test clear when disconnected at the service switch. Voltages should also be checked and if found above or below specified voltages, (allowing not over 3% voltage drop under load) the transformer taps should be interchanged to produce proper secondary voltages.

(2) Test the operation of all switches and pull chain devices. Test all sockets and receptacles for current.

(3) Test the operation of all motors and control equipment for the type of operation specified.

(4) See that all accessory materials and operating equipment are furnished as specified or required by the contract.

(5) See that the proper size fuses are installed and relays or other protective equipment are properly adjusted to give adequate protection to the systems.

(6) Some of the more important items to check are listed below:

(a) Wire types R, RW, RI and RH installed where specified.

(b) Color coding used for feeders and branch circuits. White should identify neutral or ground conductors. Each other conductor in the same raceway should be of a different color.

(c) Double locknuts installed where specified. Conduits containing three phase circuits over 150 volts to ground should be provided with double locknuts.

(d) Red lead specified on all conduit threads.

(e) Threaded hub, conduLet type, fittings specified for exposed work.

(f) Full size 4" square or octagonal pressed steel boxes, with plaster covers, specified for concealed work.

(g) Unused holes in boxes to be closed with metal.

(h) Boxes set flush. Built-in type fixtures should be covered with 1/2" sheet asbestos where installed in wood framing.

(i) Barriers installed to separate wiring in combination outlets involving electrical and door bell or radio outlets.

(j) Conduit and neutral conductor grounded in each building.

(k) Three or four wire branch circuits balanced across three or four wire feeders.

(l) Equipment provided with Underwriters' label. Material as approved. Identification or directories provided.

34. ELECTRICAL DISTRIBUTION SYSTEMS.

a. Underground fibre and cement asbestos ducts are easily broken during grading operations unless extreme care is used. All grades, elevations, locations, etc., should be checked and recorded by a certifying engineer before back-filling.

b. Transformer specifications generally require conformance with the A.I.E.E. and N.E.M.A. standard requirements. These standards require the furnishing of accessory devices, such as temperature gauges, oil sampling devices, etc., depending on the size and type specified. Consult Engineer for specific requirements.

c. Over-potential tests on all underground primary cables should be witnessed. When no test voltage is specified, it is considered good practice to test at twice operating voltage, plus a thousand.

d. In pole line construction, care should be taken that poles are set at depths specified and properly guyed. It is important that poles be of the type, size and class as specified, having a factor of safety as required by the contract. It is suggested that a copy of the American Standards Association Specification for Wood Poles be procured.

e. Drawings for overhead distribution systems are generally diagrammatic. Generally, certain pole locations will have to be shifted due to landscaping, sidewalks, curbing and

other interferences. It is more desirable to have the poles in alignment but where this cannot be accomplished, the most workable installation should be had.

f. Anchor rods should not project more than six or eight inches above ground. The size and length of grounding rods should be compared with those specified and should not project more than three inches above ground.

g. The sag of wires between poles should be checked with the sag allowed by the Specification (allowances for temperature changes) and evenness. Particular attention should be given to the method of dead-ending and changes in direction as required by the contract.

h. (1) Guy wires on poles not to be overloaded.

(2) Wood molding provided to protect ground wires on poles.

(3) Balanced tension on cross arms and terminals.

(4) Bolts on poles not to project more than 1/2".

(5) Thermal indicators on transformers installed in a readable position.

(6) Transformer size indicated in 3" white letters.

(7) Service entrance cables or raceways concealed in framing to have fuses provided at the outer ends.

(8) Service head not less than 8' above ground; point of attachment of service drop more than 10' above ground or not less than 36" from windows.

(9) Oil curb provided around transformers located in vaults.

(10) Underwriters' approved door used for transformer vaults.

(11) Danger signs and safety equipment provided.

i. When the distribution system is completed, it should be subjected to a high voltage test, as specified, or in accordance with the National Electrical Safety Code. Voltage readings should be taken at each building, and necessary adjustments of transformer taps should be made at this time. Three copies of test reports should be provided for the FTHA representative.

j. Record drawings should be kept up to date by contractors. Any changes in design or deviation from contract drawings should be indicated thereon concurrently with changes. Final record drawings of distribution systems should indicate the exact location of all underground cables and splice boxes with respect to location of buildings, walks, etc. Where monuments or markers have been provided, these should be indicated on the drawings.

35. HEATING - GENERAL.

a. Verify location of all existing underground utilities and structures and take steps to avoid interference with same in the installation of new work.

b. Urge prompt listing by Contractor of all available pipe line welders and for qualification tests of welders and process, if required.

c. Determine approval and availability of qualified testing agency and/or certifying engineer for line testing and grade and line certification when Specification requires same.

d. Arrange for coordination of all trades involved in the installation of tile conduit so that they will proceed in orderly sequency without interruption and without delay due to insufficient number of welders.

36. UNDERGROUND SERVICE. Careful observations should be made frequently to detect and secure the correction of the following unsatisfactory conditions:

a. Improper location of new services and damage to and interference with other services and structures.

b. Installation of supporting slabs or tile conduit on or adjacent to unstable earth or frozen earth, the thawing of which would dislocate or otherwise damage the work.

c. Installation of cracked or broken tile conduit.

d. Omission of adequate filling in conduit joints and waterproofing, where specified, of those joints over the entire circumference of the conduit.

e. Obstructions in or near base drains and conduit which would interfere with proper drainage of the conduit system.

f. Improper spacing, location or support of pipe rolls, hangers, alignment guides and anchors which might permit pipe to sag, lose alignment or expand improperly.

g. Insecure wiring of covering to pipe and the lack of protection of insulating materials which are subject to disintegration from dampness.

h. The use of bulldozers or other careless means of backfilling around and over tile conduit which would subject the tile to breakage from falling stones, rocks, frozen earth or other similar material.

i. The possibility of stoppage of underdrains and conduit because of inadequate crushed stone fill or because of proximity to tree roots.

j. The possibility of damage to tile conduit after backfilling because of insufficient protection at ground surface at points which will be crossed by heavy equipment or vehicles.

k. The omission of adequate protection against conduit breakage from vibration and settlement at all street and driveway crossings.

l. Imperfect alignment and inadequate guiding of pipes at all points where corrugated expansion joints are used. Slightest misalignment at such points will eventually result in failure of the joints.

m. Careless testing of buried pipe joints, caulking of threaded joints and improper line and grade certification before backfilling.

n. The use of imperfectly matched top and bottom sections of tile conduit.

o. Improperly located or spaced inserts for piping supports in concrete tunnels.

p. Inaccessible manholes and expansion chambers.

q. Inadequate joints between tile conduit and building walls which permit an unintended sub-surface seepage into basements.

r. The omission of any specified waterproofing material around joints of all removable concrete chamber and pit tops.

37. HEATING PLANT EQUIPMENT AND PIPING.

a. Urge that the mechanical inspector and contractor carefully check location, size and spacing of all sleeves, inserts, foundation bolts, foundations and openings through floors, walls and roof before concrete is poured.

b. Urge that arrangements be made for prompt delivery and tests, if required, of refractory materials for boiler settings and chimney.

c. Precautions should be taken to avoid erection of chimney and boiler settings during freezing weather unless inconsistent with necessary progress and extraordinary protection against damage from frost is provided until all mortar has properly set.

d. Urge that all necessary precaution be taken to avoid accumulation of moisture on interior surfaces of steel boilers and all boiler settings, incinerator linings, etc., until this equipment is actually placed in service.

e. Recommend installation of boiler baffles prior to erection of boiler side walls and examine same closely for cracks and leaks. Also, check location and dimensions of same against approved shop drawings and contract plans and specification.

f. After erection of boilers and before starting brick settings, observe that all specified hydrostatic tests are performed in the presence of insurance company inspectors where required, and that boilers are retested where correction of leaks is undertaken. Continual dripping of water at any point in drums, tubes or water legs should be considered leaks, whereas, the formation of drops of water on such surfaces without dripping is usually permissible without corrections. Hydrostatic tests should be avoided during weather which causes the accumulation of condensation on exterior surfaces. The manner of correction of leaks should be left to the discretion of the manufacturer, who is invariably held responsible for any subsequent failure due to repeated rerolling of tubes, or to other similar causes.

g. During erection of boiler settings, precautions should be taken to prevent the use of cracked or broken brick or tile and to insure thorough coating with mortar except as otherwise specified. Joints should be as narrow as possible in fire brick and silicon carbide block and should be entirely filled with mortar. Recognized standards in this trade require that refractory brick be dipped in high temperature cement or fire clay mortar of batter consistency rather than to apply mortar by trowel. The use of ground or cut brick in preference to standard shapes should be avoided on all surfaces exposed to flame or high temperature. Particular vigilance should be exercised; (a) to avoid the use of more than one quality or brand of brick in any one section of the setting, (b) to prevent refractory materials from becoming wet, (c) to obtain proper

provision for expansion of the settings, (d) to eliminate all sources of air leakage through settings, (e) to obtain proper clearance between settings and stoker mechanism, (f) to have settings carefully and slowly dried out with wood fires for approximately ten days before generating steam.

h. Until ready to generate steam, the boilers should be kept either entirely free of water with all openings in steam and water spaces sealed, or they should be completely filled with water to a point above the highest outlet.

i. Plates over top row of boiler tubes should be anchored sufficiently to prevent buckling from heat, and joints in insulating brick above such plates should be properly broken and so located as to prevent gas leakage. Where specifications make no provision for this protection, it is advisable that the matter be called to the attention of the Regional Office.

j. Care should be taken to assure most advantageous location of peep-holes and observation ports so that they will be entirely accessible and provide maximum view of furnace.

k. All foreign matter and obstructions should be removed from air passages and dampers in air-cooled settings.

l. Recommend that the Mechanical Inspectors and Contractor carefully check location and size of all openings through settings for soot blower elements and for draft gauge, gas analysis and gas temperature piping, et cetera. The use of special heat resistant sleeves where specified and the dimensions and extent of projection of all such sleeves or pipes which are required to extend into settings, should also be verified.

m. Examine stokers for freedom from binding in all movable parts and observe test of shear-pins or links for effectiveness before placing stoker in operation.

n. Urge that precautions be taken to provide adequate protection of all exposed movable parts of all equipment with grease, oil, et cetera, and that all equipment be protected against damage from carelessly handled materials, falling debris and accumulations of dirt and dust.

o. The presence of sufficient lubrication in all moving parts and proper alignment of these parts should be carefully verified before equipment is placed in operation.

p. Check applicable Safety and Boiler codes for requirements with respect to machinery guards, guard rails, tank and heater overflow lines, high pressure trap and safety valve

discharge openings; compare same with contract requirements and actual installation and take steps to obtain clarification of contract requirements in cases of ambiguity, discrepancy or dispute.

q. Urge adequate bracing and supports for all piping connecting reciprocating pumps to avoid vibration.

r. It is imperative that means be provided to avoid contact between larry operating chains and bare trolley wires and that metal guards be provided over pipe covering to protect same at all points subject to damage from valve operating chains.

s. Coal scale should be calibrated by local Departments of Weights and Measures and coal larry, coal bucket and stoker hoppers should be loaded and checked against specification capacity requirements.

t. The location of all flow meter orifice plates and adjacent metering pipe nozzles should be verified by actual measurement and the pitch of all meter and instrument piping should be checked against manufacturer's published recommendations. The removal of all traps or pockets in such lines and the installation of plugged openings at low points or sharp changes in direction of piping for cleaning and drainage purposes are essential for proper operation of the instruments.

u. Pressure calibration and operating characteristics printed on manufacturer's name plates on flow meters should be checked for compliance with specified plant operating pressures. Observe that meter charts furnished are of the specified type, and that meters are serviced and placed in operation by manufacturer's service representatives.

v. During preliminary operation of plant, observe that all boilers and piping are thoroughly cleaned out under steam pressure with returns wasted for several days, or at least until all evidence of dirt, scale, grease and oil disappears from return water.

w. Before heavy fires are carried in boilers, combustion control equipment should be adjusted by a factory representative and free operation of all dampers in air supply passages, uptakes and smoke breeching should be observed. Also observe that control mechanism properly actuates dampers, motors, turbines, engines, et cetera, before continuous operation is attempted.

x. The reliability of feed water regulators, boiler and heater safety valves, high and low water alarms, boiler stop and check valves, feed water treatment apparatus and

all other specified safety devices should be observed before the plant is permitted to operate at or near capacity.

y. During the preliminary operation of the plant all necessary adjustments should be made on all draft gauges, flue gas analyzers, flue gas thermometers, boiler and auxiliary steam gauges, pressure reducing valves, back pressure valves, pump and engine governors, vacuum breakers and regulators, motor operated and remote control valves of every description, coal and ash conveying equipment, and auxiliaries and all other equipment listed under Item 24 above.

z. Accessibility of all valves, strainers and other apparatus requiring frequent service should be verified.

aa. Every precaution should be taken to prevent caulking of threaded pipe joints.

bb. Verify presence of strainers on inlet piping connections to all pressure reducing valves, vacuum pumps and all other equipment for which strainers are specified or shown on contract drawings.

cc. Before acceptance of the project, and during operation of the plant, all traps, strainers, sediment pockets, boiler mud drums and tubes, interior of boiler settings and hoppers for ash, soot and cinders should be frequently inspected and all accumulations removed.

dd. If laboratory facilities are available, it is advisable to obtain samples of city water, condensation from return system and boiler feed water for analysis to determine presence of substances which might damage interior surfaces of boilers and to encourage adoption of steps to neutralize damaging impurities.

ee. Every precaution should be taken to avoid careless or damaging operation of boilers and all other equipment and to require complete correction of damage so caused before acceptance of the project. Ultimate inspection of all external and internal surfaces of boilers and settings immediately prior to acceptance and correction of all existing defects at that time is recommended.

ff. During preliminary operation of the boilers and prior to official tests, all brickwork and boiler casing seams, setting door frames, chimney connections and door frames, cinder trap seams and boiler settings should be checked for draft leaks by means of a lighted candle or some other similar device and correction of all such leaks required.

38. BUILDING HEATING.

a. It should be recommended that the Mechanical Inspectors and Contractor carefully check the location of all pipe sleeves for piping interference with windows, doors and other construction, to insure that sleeves for continuous risers are placed directly above each other, to provide sufficient clearance for expansion and escutcheons, to provide for centering radiators on windows when so indicated, etc. A similar check of hanger insert locations is also to be recommended.

b. Precautions should be taken to insure that all return piping is installed to permit gravity flow and without pockets or lift fittings unless otherwise specified, that the specified minimum pitch is provided and that the pitch corresponds with the requirements of any temperature control equipment to be installed, that the lines are located to avoid every possible interference with the operation of doors and windows and that the specified minimum head room is maintained.

c. Because of their unsightly appearance, every precaution should be taken to avoid crooked risers and to prevent the use of bent pipe and an excessive number of fittings at radiator connections. Adequate provision for expansion should be made in radiator connections, however.

d. Thermometers, gauges, etc., should be so located that their dials are entirely visible.

e. It is advisable that safety valves be installed on low-pressure side of all pressure reducing valves, and that the escape openings be piped to the nearest floor drain unless otherwise specified.

f. Precautions should be taken to prevent damage to pipe covering from moisture and dampness. A continuous circulation of air in spaces where this material is installed is essential and the application of the first coat of any specified sizing or paint as soon as the covering is dry will act to prevent mildew and disintegration.

g. The installation of scale pockets at all drip points and mains on the inlet side of traps is desirable and, when specified, should be provided with threaded caps, or other means of access for cleaning.

h. It should be recommended that Mechanical Inspectors carefully check the radiation surface actually installed against that specified or shown on drawings for each room throughout the project, and that a check be made to ascertain that the supply end of each radiator is slightly higher than the return end.

i. When the heating system is first operated, it is advisable that all condensation be removed by gravity, that the elements be removed from all traps, and that all condensation be wasted to the sewer until all evidence of dirt and grease disappears from the returns. Vacuum pumps and trap elements should not be placed in service until the system has been cleaned. Should these precautions be inadvertently neglected, all traps, pumps, strainers, pressure reducing valves, scale pockets, etc., should be serviced and thoroughly cleaned after the system has been in operation at least ten days in any event before it is finally tested or accepted.

j. It should be carefully observed that all equipment is in good working condition, that all necessary service representatives will be available, that a noiseless circulation of heat throughout all rooms in the project is obtained, and that every possible preliminary adjustment and preparation is made before any specified final tests or inspection are commenced.

k. See that radiator and riser runouts are installed with [illegible] fittings, if so specified.

l. See that the radiators are set up and connected so as to relieve all strain on piping connections and to provide firm bearing for all four legs of the radiator.

m. See that exposed heating risers and branches are properly braced and supported and that provision is made to avoid vibration in this piping.

n. See that painted inserts, if specified, are installed, and that hangers are painted immediately after installation, if so specified.

o. See that the specified thickness of covering on water heaters and boilers is installed.

p. See that all temporary hangers are removed.

q. See that specified covering is installed on all heating lines.

r. See that all boiler instruments specified have been installed.

s. See that [illegible] have been connected up.

39. GENERAL - ALL PIPING.

a. It should be observed that all piping is tested in accordance with specification requirements and that tests are applied and necessary repairs made before the piping is enclosed or insulated whenever possible. Certification of tests by an insurance company, when so specified, should also be verified.

b. Mechanical inspectors and contractors should be cautioned regarding the necessity for maintaining perfect alignment in piping adjacent to corrugated or telescopic expansion joints and for avoiding every possibility of strain on cast iron fittings due to expansion and contraction of piping. Furthermore, the actual installation of all expansion joints, bends, swing joints and offsets as specified should be verified, particularly in risers and in basement piping.

c. It should be observed that piping generally is supported at the specified intervals with hangers designed in accordance with plan and specification requirements, that anchors are structurally secure and properly located with respect to expansion points and that normal expansion and contraction will not interfere with other construction, piping or equipment.

d. In cases where genuine wrought iron pipe is specified, the appearance of the material should be carefully noted and the presence of such distinguishing marks as the manufacturer's name, knurling and spiral bands peculiar only to that type of pipe should be determined in order to prevent use of inferior materials which often have a similar appearance to a casual observer.

e. Since there is a wide variation in price of various valves of the same type and between standard weight and extra heavy valves and fittings, careful observation of these materials is essential to detect non-compliances. Particular attention should be given to pressure markings which invariably appear on the bodies of valves to determine that the Steam Working Pressure (S.W.P.) or Water Working Pressure (W.W.P.) for which the valves are designed agree with specification requirements.

f. All threaded pipe should be reamed and the caulking of threaded joints should be prevented. Where welding is permitted, the ends of all pipe and welding fittings should be beveled.

40. LINES AND LEVELS.

a. All building lines and grade levels should be carefully checked in relation to buildings on the plot, and in connection with the adjoining properties, together with levels of all finished grades.

PART II

INSPECTION OF LANDSCAPE WORK

1. SELECTION OF MATERIALS. Topsoil should comply with physical conditions of specification as to friability, freedom from clay or gravel subsoil or foreign matter of any kind, and typical of topsoil of locality. Any analysis for chemical availability if secured from State Agricultural Experimental Station or laboratory (not as a rule a contract requirement) should be used for the information it contains. Approval of a certain supply of topsoil if otherwise satisfactory may be conditioned on a supplementary fertilizer.

a. Plant Materials.

(1) Plant materials should be inspected for compliance as to species, variety, size and general characteristics. Experience indicates that as a rule a better selection as to quality and shape is secured if this inspection is made before digging in the suppliers' nurseries. However, delivery may be permitted on the Contractor's responsibility, subject to inspection at the project. Inspection for size and shape should take into consideration the following: For shade trees, caliper is as a rule the determining dimension, height and spread are specified to secure normally-grown specimen stock. Non-compliance with height specification usually indicates stunted or overly-tall gangling trees grown too close together in the nursery. For ornamental trees and shrubs, height and spread are usually the determining dimensions.

(2) Upon delivery, examination should be made to see whether proper precautions as specified had been taken in handling and during transit to prevent drying out from sun or wind, and protection from freezing or exposure to motor exhaust gases. Examination should also be made for root spread or size of ball and for any injury which would make the plant unsatisfactory. Trees have been furnished on several projects which had had their tops cut off some years previous and there had developed a decayed scar or stump which would eventually result in a weakened main stem. Such previously "topped" trees might be acceptable if the scar had not decayed and corrective surgery is possible to effect a complete healing of the stem.

(3) On the project site methods of handling and protection prior to planting (heeling-in, etc.) should be checked for conformity to Specifications and good

practice. B & B materials should be checked to see that plant and earth balls are a natural solid unit and that such materials are handled by the ball or container and not by the stem of the plant.

(4) Any offering of plant materials less than the minimum sizes specified should be accompanied by an appropriate proposal of credit on account of current price differentials.

b. Other Materials.

(1) Fertilizers or special conditioning materials should be checked for compliance or manufacturer's certified analysis.

(2) Grass seed should be checked for compliances as to quality and mixture. Manufacturer's certified analysis may be accepted.

(3) Stolons, if used, should be checked for quality and freshness.

2. SEASON. Compliance with specified season is important in order to secure the contemplated results from the specified operations. Any deviation from normal seasonal work (dormant period for deciduous trees and shrubs and a proper germinating or growing period for grasses) undertaken by the contractor for his apparent benefit should only be permitted with an acknowledgment of responsibility on the part of the contractor for the specified results. Extra precautions necessary such as supplying trees with a ball of earth instead of with bare roots, extra watering, shading or other protection from unseasonal weather conditions should be required. If such work is undertaken on the initiative of the Local Authority for the betterment or earlier completion of the project, it is probable that the contractor should be adequately compensated where justified.

3. PLANTING.

a. Check size of plant pits in accordance with specified root spreads, etc.

b. Watch for any indication of bad drainage; standing storm water in pits; areas of heavy compaction because of construction traffic; tight clay subsoil, etc. Surplus water remaining in plant pits may cause the loss of the material due to souring of the soil. Minor corrections of purely local or construction-created conditions should be the responsibility of the contractor. Latent soil conditions if severely adverse should probably be given special study

by the professional consultant and appropriate treatment with appropriate compensation to the contractor for any additional work involved if justified.

c. Watering in of plants during planting operations is important in order to compact soil about the roots and to exclude all air. Experience indicates that the majority of plant losses are probably the result of carelessness or negligence in this particular operation.

d. Pruning immediately after planting to compensate for loss of vitality and for proper development of plants is most important. Early spring growth on branches that are later to be pruned becomes an unnecessary strain on the lowered vitality of the individual plant.

e. Check should be made to see that mulching, bracing, wrapping of tree trunks or other protective measures specified are attended to immediately after planting in order to secure the contemplated results.

f. When it is plainly evident that a job condition has occurred so that a tree or shrub is indicated in an unsuitable location, such as under an overhanging existing tree, under utility wires not shown on drawings, or large-growing shrubs in front of living room windows which are close to the ground, work should not proceed until a determination is made by proper authority as to desirability of following plan in detail. With reasonable foresight, location of new planting can be shifted without disrupting the design or causing the contractor an economic inconvenience.

4. LAWN WORK.

a. Scarification of subgrade soil including the removal of all remaining building debris, wood, brick, mortar, etc., is important to obtain satisfactory bond between subsoil and topsoil layers.

b. Check for subgrade and depth of topsoil considering allowance for future settlement of scarified subgrade and topsoil layers (rolling with 200 to 300 pound rollers as usually specified does not produce eventual compaction). Finished grade should be carefully checked in locations where surface drainage must be considered. Care must be exercised to see that finished grade does not become a barrier to storm water run-off especially if there are intervening valleys to be crossed by the line of flow. Banks should in all cases be held rounded top and bottom for economy of maintenance. Where catch basins are installed, finished grade should be shaped in order that the

maximum area be drained. Where it appears necessary or advisable to stop the flow of storm water, appropriate berms with gentle slopes should be formed whether or not indicated on grading plans. Where storm water run-off is important, no abrupt changes in grade or sharp turns of direction of flow should be created.

c. Check preparation of seed bed and incorporation of fertilizer or other specified special treatment.

d. Check quantity of seed or stolons and uniformity of coverage.

e. Raking, rolling, sprinkling, etc., specified should be followed in detail in order to secure satisfactory results. Properly done, these operations minimize the danger of loss of seed in the event of sudden heavy rainfall or wind erosion.

f. Methods of securing germination and development of turf on lawns are the responsibility of the contractor but it must be borne in mind that nature cannot be depended on to give satisfactory results. The methods indicated in the usual maintenance paragraph if judiciously followed will undoubtedly assist greatly in securing the turf required. Early attention to weed growth will undoubtedly save the contractor considerable maintenance expense.

5. LANDSCAPE MAINTENANCE.

a. Landscape maintenance is provided to continue through what is considered the minimum period of time required to insure the proper establishment, continuing life and thrifty growth of plant material: trees, shrubs, hedges, vines and lawn grass. It is important that the contractor be kept cognizant of his obligation (and the Local Authority's knowledge of his obligation) to perform all the operations stipulated under this provision when and as required by natural conditions. This can be done by (1) the retention of a sufficient portion of the contract price to insure compliance until the period expires and (2) by qualified technical inspection or supervision at such frequent intervals during the period required for maintenance as to keep the Local Authority or the Management Division of the FPHA informed of his proper workmanship in this regard.

b. While these specifications do not contemplate that the landscape work should be maintained in the immaculate condition of a private estate or public institution, care should be exercised to see that the contractor keeps the project in reasonably clean and sightly condition. Weeds

should not be permitted to grow excessively in shrub beds or tree pits. These should be cultivated at intervals not only to eliminate weeds but also to stimulate growth of newly planted stock and reduce loss of moisture. Watering should not be excessively often, but sufficient when done to thoroughly soak the ground to the depth of the tree pit or plant bed whenever required. A possible tendency of some contractors to consider replacement cheaper than maintenance should be checked if observed.

c. In maintenance of the lawns, mowing should not be closer than 2 to 3 inches. Edges of lawns at shrub beds and along walks should be reasonably clean cut and high grass should be kept trimmed at building walls.

d. In the event that lawn work may be delayed for seasonal reasons so that weed growth develops in the lawn areas, care should be exercised that these weeds do not mature seed which may cause material damage or unnecessary maintenance in future years. Also if buildings are occupied weeds in yards should be kept cut until lawn work is commenced to avoid inconvenience to tenants.

e. The requirement to replace all plant materials found dead or in an unsatisfactory condition at the end of the maintenance period is not in itself sufficient protection to the project. In the first place any plant which dies is lost to the project for a full year and in the meantime becomes an eyesore. Also the mere fact of replacement of a living plant under the same conditions under which the former plant died is no surety that the replaced plant will live. Then again improper maintenance, as well as poor workmanship in handling and planting the various plant materials, may not result in the death of these plants, nor even in such poor development that the provisions of replacement can conscientiously be invoked, but may result in such loss of vitality that the plant may be stunted in growth or deteriorate over a long period of time. Qualified professional inspection and consequent knowledge that the contractor is carrying out the stipulated operations throughout the progress of the work, are the best insurance that all contract obligations have been fulfilled and that the plants will probably develop as expected.

f. The period of maintenance required under the contract should be fully understood by all concerned, because the completion, acceptance and final payment all depend on this. It is important, therefore, to keep in mind that the limiting dates set up for contract maintenance (at least sixty days after the close of the season - - etc.) are for the minimum length of time only. An inspection at the termination of this minimum period, or continuous

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i. It might be considered at the time of this final inspection that in general the work has been performed satisfactorily but that there are particular areas where for one reason or another the grass may have failed to develop satisfactorily, or some other comparatively minor matter need correction. In this event, the contractor may be relieved of the responsibility of further general maintenance over the entire project, but be required to continue his work on the particular areas in question until the required results have been obtained. Sufficient money should be retained from current payments to insure satisfactory completion of these items.

j. Replacement of plant materials is important. It is required that replaced materials and the workmanship involved comply in all respects to the stipulations for original planting. No maintenance of this material is required of the contractor, nor is there any further obligation to replace again any of these materials which might not survive, except in the case of proven faulty material or workmanship. In dealing with living materials such as plants, it must be borne in mind that the death of a plant is not sufficient evidence that the plant itself wa inferior or badly handled, but carelessness may be inferred. Full compliance with the stipulations, therefore, must be required and enforced during this operation, or the project is not getting full value for the amount of money spent on this contract.

for WILLIAM F. BEAVER
Assistant Commissioner
for Development