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No. C • 1 Start-Up

The Chief Engineer will be responsible for planning, implementing, coordinating and supervising all mechanical operations, maintenance, communications, energy management and manpower development programs to effectively and efficiently oversee and conduct necessary actions to implement the guidelines of quality standards, operating objectives, and established goals of the **Company**.

Scope

The Chief Engineer in conjunction with the **Manager** is responsible for the supervision of all assigned engineering personnel and to insure that the proper performance of all maintenance and operational tasks are implemented to assure maximum life and reliability of all systems within the property.

Authority

The Chief Engineer is directly responsible to the **Manager**, and his/her duties include but are not limited to:

A. Reviewing and signing off on all time sheets for each assigned engineering personnel.

B. Scheduling of all overtime work as required to maintain and operate assigned project under the guidelines set by Property Management.

C. Approving and coordinating schedules and vacations for all assigned engineering personnel.

D. Implementing necessary disciplinary action for all assigned engineering personnel within the guidelines of the **Company**.

E. Issuing purchase orders for services and supplies within the project budget guidelines and property management procedures.

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Duties, Responsibilities and Accountability

The Chief Engineer, in conjunction with the **Manager**, is responsible for the general maintenance and operation which includes, but is not limited to:

A. Implementing proper general maintenance and operations for:

1. HVAC Systems and Equipment;
2. Central Plant;
3. Energy Management Computer Operation;
4. Basic Electrical;
5. General Building Maintenance; and
6. Fire Safety Equipment.

B. Specific Functions

The Chief Engineer in conjunction with the Assistant Chief Engineer, if applicable, is responsible for the daily operations and maintenance performance, but is not limited to:

1. Supervising the operation of the central plant chillers, all air conditioning units, heat pumps, heat exchangers, air handling equipment, fans, terminal VAV units, automatic temperature controls, electrical switchgear, distribution switchboards and valves, plumbing fixtures and other miscellaneous mechanical and electrical equipment and systems in the building.

2. Conducting regular inspections of operating mechanical and electrical systems and equipment in accordance with standard operation procedures. Checking and recording temperatures, pressures, air flows, water flows, and chemical readings in accordance with standard procedures.

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3. Performing preventive maintenance duties such as filtration system changes, lubrication, inspection and adjustment of fan belts and pulleys, cleaning of evaporator and condenser tubes and coils, ballast replacement, and fan and motor bearing replacement.

4. Implementing necessary adjustments to operating equipment and controls to ensure safe, reliable and efficient operation.

5. Maintaining cleanliness of all spaces in which mechanical and electrical equipment is located. Includes central plant, cooling tower area, garage mechanical rooms.

6. Performing the physical duties required to correct emergency conditions such as sewer back-ups, water flooding into building office space and related incidents.

7. Answering and ensuring that service calls and requests from tenants relating to mechanical, electrical or HVAC problems are completed with proper corrective action.

8. Reviewing all available equipment technical information to further your understanding of the design and operating characteristics of the building equipment and systems.

9. Taking an active interest in personal and professional development of engineering staff.

10. Assisting and conducting routine scheduled inspections of Fire and Safety equipment, central plant equipment and all related facility equipment.

C. Purchasing

The Chief Engineer in conjunction with the **Manager** is responsible for the purchase of parts and supplies required within the area of responsibility and approved budget guidelines.

D. Inventory Management

The Chief Engineer in conjunction with the **Manager** is responsible for the implementation and administration of necessary inventory control programs and systems to assure

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maintenance of parts inventory levels and accurate timely records of receipts and issues under to guidelines of the **Company**.

E. Lease Administration

The Chief Engineer in conjunction with the **Manager** is responsible for, but is not limited to:

1. Evaluating all tenant working drawings regarding existing M.E.P. modifications.

2. Monitoring the construction and remodeling of all areas in the buildings as they relate to M.E.P. systems.

3. Assisting Tenant Construction as needed under the guidelines of Property Management.

4. Evaluating Tenant compliance with respect to operations and energy provisions of the lease.

5. Addressing tenant questions concerning M.E.P. operations.

6. Analyzing tenant supply usage, operating cost for HVAC and excess energy billings.

7. Assisting all leasing agents with access, systems information, keys or as needed under the guidelines of the **Company**.

F. Expense Management

The Chief Engineer in conjunction with the **Manager** is responsible for, but not limited to:

1. With regard to suppliers:

   a. Coordinating updated suppliers' pricing list.
   b. Recommending types of vendors.
   c. Issuing purchase orders or receipts of contract.
   d. Confirming proper receipt of goods or services.

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2. With regard to outside M.E.P. contractors:

   a. Evaluating performance.
   b. Evaluating contract cost.
   c. Providing competitive bidding.
   d. Recommending contractors.
   e. Maintaining quality and cost controls.

3. Maintaining accurate and timely engineering expense records and files.

4. Coding and approving of all engineering accounts payable invoices.

G. Accounting Management

The Chief Engineer in conjunction with the **Manager** is responsible for, but not limited to:

1. Preparing the annual budget for utilities, supplies, repairs and maintenance and subsequent budget revisions.

2. Approving all designated engineering personnel time sheets (including pre-approval of overtime).

3. Preparing monthly expense accruals.

H. Management Information Systems

The Chief Engineer in conjunction with the Assistant Chief Engineer, if applicable, is responsible for, but not limited to:

1. Preparing required energy management reports.

2. Participating in property visitations and implementing all recommendations.

3. Maintaining required accident records and emergency reports relating to engineering matters.

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4. Maintaining current and historical preventive maintenance records.

5. Reviewing energy management information and appropriate action to minimize energy consumption.

6. Preparing monthly tenant request summary reports.

I. Organization and Personnel

The Chief Engineer in conjunction with the **Manager** is responsible for, but not limited to:

1. Ensuring all engineering personnel adhere to policies and operating procedures.

2. Maintaining current position description for all engineering department positions.

3. Assisting in the preparation and maintenance of approved staffing tables.

4. Participating in the hiring of subordinate personnel under the guidelines of the **Company**.

5. Developing in-house training and educational programs for all engineering personnel.

6. Assisting in the preparation and/or recommendation of all action plans, evaluations, and salary administration for engineering personnel.

7. Monitoring and implementing OSHA requirements for assigned property.

J. Physical Facilities Management

The Chief Engineer in conjunction with the Assistant Chief Engineer, if applicable, is responsible for, but not limited to:

1. Managing and maintaining all facility equipment.

2. Understanding of the property's security systems in conjunction with the building operations.

3. Coordinating and implementing the energy management programs.

4. Establishing and implementing an effective preventive maintenance program.

5. Implementing the fire and emergency procedures for all engineering staff.

6. Ensuring that all emergency equipment is in good working order and in compliance with all local codes.

7. Conducting regular inspections to ensure maximum quality and consistency within the total property.

K. Miscellaneous Responsibilities

The Chief Engineer is responsible for, but not limited to:

1. Reporting to work on time and ready to work.

2. Dressing for work in appropriate attire which should be neat in appearance (pressed) with prior approval by the **Company**.

3. Checking with **Manager** each day for any building events duties scheduled for that day or incidents to be reported.

4. Reporting any events which transpired the day before or during the weekend duty to the **Manager**, along with an Incident Report, the following day. For emergencies of any type, contact the **Manager** right away. *No problem is too small; if you are not sure, call.*

5. Reporting incidents of any type -- mechanical, tenant, auto, or personal -- that involve the building to the **Manager**.

6. Reporting any personal difficulties or conflicts with each other or any non-engineering person to the **Manager**.

7. Attending scheduled staff meetings called by the **Company or Manager**.

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8. Maintaining departmental records in accordance with established guidelines.

9. Maintaining good working relationships will all tenants, responding to tenant complaints/requests in a timely and professional manner.

10. Maintaining effective employee communication and good work relationships.

11. Assuming additional responsibilities as delegated by the **Company**.

L. Building Inspections

The Chief Engineer in conjunction with the Assistant Chief Engineer, if applicable, is responsible for attending and conducting, on a timely and recurring basis, property inspections as scheduled but is not limited to the following areas:

1. Scope

    a. Tour all physical facilities.
    b. Review of preventive maintenance program.
    c. Review of energy conservation programs.
    d. HVAC equipment performance testing.
    e. Review of water treatment programs.
    f. Review of engineering manpower levels.
    g. Base building and tenant construction.
    h. General building maintenance.
    i. Provide conclusions and recommendations.

Daily Work Routines

The Chief Engineer will be responsible for, but not limited to, developing Daily Work Routine procedures for each engineering personnel and work shift. Routines should include Start-up Engineer, Day Engineer, Shut-down Engineer and Saturday Engineer, as shown in the following examples:

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Daily Work Routine Example

DAILY ROUTINE WORK PROCEDURES
START UP ENGINEER

Schedule: 0600-1400

0600-0800

Building A

A. Dressed in uniform.
B. Check fire alarm panel and dry pipe room for proper operation and log in.
C. Start chillers and related equipment.
D. Check cooling tower for proper operation.
E. Take make up water meter reading.
F. Turn 7th and 8th floor convector units on.
G. Check air compressor level.
H. Conduct water treatment test on Mondays.

Building B

A. Check roof top HVAC system for proper operation.
B. Check temperature setting on conference room unit, check fan for "ON" position and temperature setting at 72.
C. Check the fire alarm panel and dry pipe room.
D. Check air compressor oil level.
E. Check the operation of the D.S.C. panel for any alarms.
F. Take readings and adjust the temperature as necessary.

0800-1400

A. Check with the Engineering Supervisor for further instructions.
B. Review previous day's work assignment (if not complete, reassign.)

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C. Help with work tickets as necessary.

WEEKLY:

A. Check all air handlers for proper operation.
B. Check sump pumps every Saturday.

DAILY ROUTINE WORK PROCEDURES
SHUT DOWN ENGINEER

Schedule: 1200-2000

1200-1300

A. Dressed in uniform and report to the Assistant Engineering Supervisor for instructions.
B. Make rounds of Chiller Plant and take readings.
C. Check the cooling tower for proper and continued operation.
D. Check Building B HVAC system, take readings and make adjustments to temperature and static pressure as necessary.
E. Check with Property Management Secretary (Building B) for any work tickets.
F. Conduct water treatment on Friday.

1300-1800

A. Proceed with work tickets or preventive maintenance assignments.

1700

A. Check with Property Management (Building B) for any work tickets.

1800-2000

A. Check fire alarm panels at Building B and log in.
B. Set Building B temperature set point up to 57 in Spring/Fall, 51 in Summer and 68 in Winter, or as needed.
C. Set Building B main conference room thermostat at 75.

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D. Check Building A domestic water, and sewage ejector pumps.
E. Check Building A fire alarm panels and log in.
F. Check the air compressors for proper operation.
G. Secure the chiller(s) and related equipment.
H. Place all complete and incomplete work tickets on the Assistant Engineering Supervisor's desk for review the next day.

Each day the work routine should include the following:

A. The readings on the HVAC system at Building B are mandatory for all Engineers.

B. All Engineers will be required to familiarize themselves with this daily routine work procedure.

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No. C • 2 Overtime HVAC

The intent of this section is to be familiar with the program and operating costs associated with OTAC equipment calculation format, that the **Manager** conducts for each project. This computerized program is not available for use but the **Manager** is available to demonstrate the program and how the final cost values are determined.

OTAC Format

The following format was used to determine each project's operating expenses for OTAC. Although this is done in an attempt to standardize calculations, not all projects will utilize every part of the calculation format. Accordingly, clearly indicate any deviations from the standard format on your calculation package, and forward comments to the **Manager**.

Calculation Guidelines

1. All projects will include (Equipment Depreciation) in their calculations. Verify with the **Manager** for the Estimated Life Factor.

2. It is understood that Water Chilling Units operating at partial load for overtime use will consume more KW per Ton than at full load. For the sake of this calculation, however, we will use (designated KW per Ton).

3. Projects that operate their central plant continuously will show on their calculation package only those costs attributed to the overtime use.

4. Concerning labor costs, it is the position of the **Company** that engineering labor relative to plant operation will be required in most cases. Use the projected operating hours multiplied by $15.00 per hour for your manpower calculations.

5. If your control system specifics can easily provide "ventilation only" (no heat/no cooling-circulation of air handling unit only), provide a separate calculation. If you cannot provide "V.O.", begin research on how we can accomplish this for later discussion.

6. Minimum load for Water Chilling Units over 300 Tons will be 30% of full load. Minimum load for WCUs 300 Tons and smaller is at your discretion, but is assumed not to be over 30% of full load.

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7. At times, you may have overtime requests in excess of "minimum load." The calculation considers this and includes "minimum load" and "other load conditions." The formulas are the same, and they are included to clarify and simplify the calculation.

8. In most cities, code requires the introduction of fresh air and the removal of toilet exhaust anytime the building is occupied. It is recommended that these be operated and associated costs be the overtime calculation.

9. Formulas that include equipment amperage should use actual operating amps in lieu of nameplate amperage.

10. Relative to the chilled water/condenser water pump calculation, it is understood that electrical consumption for the chilled water pump will change with the number of AHUs operating. For this calculation, however, we will use the operating amperage of both pumps at the minimum load condition, as the difference would be negligible.

11. In regard to cooling water fan electrical calculation, an assumption of 50% run time of one fan may be used. Feel free to calculate using actual conditions if these conditions can be verified.

12. Air compressor run time percentage is assumed to be 33% for all projects. At 100% occupancy verify actual run-time to estimate.

13. On equipment depreciation, industry standards recommend using 30 years for estimated equipment life and $785.00/ton of plant capacity for equipment cost. If you can identify actual cost, please do so.

14. Relative to the equipment maintenance calculation, total the project budget amounts for account (#) - Filters, Water treatment, and HVAC Supplies for use in your total maintenance costs.

15. When calculating the AHU electrical consumption of Variable Air Volume systems, use actual operating amperage of the AHU at least two hours after start-up.

16. It is the intent of the 20% overhead to recover the costs of relative to overtime heating. You may adjust the number to reflect actual costs incurred.

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This calculation has been structured to assure fair and equitable billing of overtime HVAC in those instance where numerous tenants request overtime HVAC. On the following work sheets enter your cost values only in the "green cells," or unprotected cells where information values are required.

The following data will be required to conduct the OTAC calculations:

1. Project Name
2. Chiller Unit
3. Chiller Tonnage Capacity
4. Chiller Design KW per Ton
5. Min. Load # AHUs & VAV Boxes
6. Average Amperage per AHU
7. Building Average Voltage
8. Average Cost per KW
9. # Condenser Pumps
10. Total Condenser GPM Rate
11. Cycles of Concentration
12. Chill water pump Amperage
13. Condenser pump Amperage
14. Cooling Tower Amperage
15. Cooling Tower Run-time
16. O.A. & T.E. Fan Amperage
17. Air Compressor Amperage
18. Air Compressor Run-time
19. Equipment Cost for Plant
20. Equipment Estimated Life
21. Annual Run-time
22. Maintenance Cost:
    a. Air filters
    b. Water treatment
    c. HVAC Supplies
    d. Misc. Supplies
    e. Man-power
23. Water & Sewage Cost

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Calculation Example

Step One -- Electrical Costs

A. Water Chilling Unit

(1) Condition #1 -- Minimum Load (4 AHUs):

Design KW per Ton x minimum load = Total Ch

.71 x 30% of 300 Tons = Total Chiller KW at condition #1

.71 x 90 = 63.90 KW

(2) Condition #2 -- Other Load (5 AHUs):

Design KW per Ton x load = Total Chiller KW at condition #2

.71 x (min. load in tons ÷ number of AHUs run at min. load)

x 5 = Total Chiller KW at condition #2

.71 x (90 ÷ 4) x 5 = 79.9 KW at condition #2

(3) Condition #3 -- Other Load (6 AHUs):

Design KW per Ton x load = Total Chiller KW at condition #3

.71 x (min. load in tons: number of AHUs run at min. load)

x 6 = Total Chiller KW at condition #3

.71 x (90 ÷ 4) x 6 = 95.85% KW at condition #3

NOTE: Carry out the calculation to the extent necessary.

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B. Air Handling Units:

(1) Condition #1 - Minimum Load (4 AHUs):

No. of AHUs x Volts x Amps x square foot of phase ¸ 1000
= Total AHU KW at condition #1

4 x 480 x 14 x 1.732 ÷ 1000 = 46.6 KW

(2) Condition #2 -- Other Load (5 AHUs):

Use same formula and carry out as with the Water Chilling Unit calculation.

C. Chiller Water and Condenser Water Pumps

Volts x (Amps/CWP + Amps/CHWP) x 1.732 ÷ 1000
= Total Pump KW at all conditions

480 x (35 + 30) x 1.732 ÷ 1000 = 54 KW

D. Cooling Tower Fan

Volts x Amps x 1.732 x % run time ÷ 1000 = C.T. KW at all conditions

480 x 52 x 1.732 x .5 (50%) ÷ 1000 = 21.6 KW

E. Outside Air and Toilet Exhaust Fans

Volts x (Amps/T.E. + Amps/O.A.) x 1.732 ÷ 1000 = Total Fan KW at all conditions

480 x (14 + 18) x 1.732 ÷ 1000 = 26.6 KW

F. Air Compressor

Volts x Amps x 1.732 x .15(15%) ÷ 1000 = Total Air Compressor KW at all conditions

480 x 10 x 1.732 x .15(15%) ÷ 1000 = 1.3 KW

G. Total Electrical Costs

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(1) Condition #1 -- Minimum Load (4 AHUs):

Water Chilling Unit	--	63.9 KW
Air Handling Units	--	46.6 KW
Chilled/Condenser Pumps	--	54.0 KW
Cooling Tower Fan	--	21.6 KW
Outside Air/Toilet Exhaust	--	26.6 KW
Total KW Condition #1	--	214 KW

(2) Condition #2 -- Other Load (5 AHUs):

Carry out the totalization for however many "conditions" you used in the water chilling unit and air handling unit calculations.

Step Two -- Water Costs

The evaporation rate is generally 1% of the total condenser water GPM flow less 4 cycles of concentration. The District of Columbia Water and Sewer charge equals $2.86 per 100 cu. ft. or 750 gallons. One cubic foot of water equals 7.5 gallons.

The unit cost per gallon is based on $2.86 ÷ 750 gallons equated to $.0038.

A. Condition #1 -- Minimum Load 90 Tons (4 AHUs):

Evaporation Rate = 1% of GPM rate	= .30% Ton
Number of Pumps: 1	= 900 PGPM
Total Pump GPM Rate: 900	= 9 1% Rt
Bleed Cycles = (Egpm/C-1) 4 cycles	= 3 CGPM
Total Make-up = Rate + Cycles	= 12 TMup
Hourly Evaporation rate = E rate x 60 min.	= 720 HMup
Number 1 Load Tonnage x Hourly E rate = Make-up rate	= 216 LMup
Make-up Rate x $.0038	=$0.82 Prhr

B. Condition #2 -- Other Load (5 AHUs):

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Evaporation Rate = 1% of GPM rate	= .35% Ton
Number of Pumps: 1	= 900 PGPM
Total Pump GPM Rate: 900	= 9 1% Rt
Bleed Cycles = (Egpm/C-1) 4 cycles	= 3 CGPM
Total Make-up = Rate + Cycles	= 12 TMup
Hourly Evaporation rate = E rate x 60 min.	= 720 HMup
Number 1 Load Tonnage x Hourly E rate = Make-up rate	= 252 LMup
Make-up Rate x $.0038	=$0.96 Prhr

Step Three -- Equipment Depreciation

$$\frac{\text{Equipment Cost}}{\text{Estimated Life x Annual Run Time}} = \text{Depreciation Cost}$$

$$\frac{\$475{,}000}{30 \times 3{,}640} = \$4.35$$

Step Four -- Equipment Maintenance Cost

Maintenance Costs: annual operating hours = Equipment Maintenance Costs

$12,550 ÷ 3,640 = $3.45

Step Five -- Totals Calculation

A. Condition #1 -- Minimum Load (4 AHUs):

1. Total Electrical Costs -- Condition #1 -- 214 KW x $.065 = $13.91
2. Total Water Costs -- Condition #1 -- 216 x $.0038 = $.82
3. Equipment Depreciation = $4.35
4. Equipment Maintenance = $3.45

Subtotal Hourly Cost -- Condition #1 $22.53

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Overhead = + 20%	4.50
Total	$27.03 /hr

B. Conditions #2 -- Other Load (5 AHUs):

Carry out the totals calculations for however many "conditions" you used in the water chilling unit, air handling unit and water cost calculations.

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No. C • 3 Meter Readings

The Chief Engineer will be responsible for conducting monthly meter readings for all electrical submeters for tenant and base building usage.

For those projects not required to billback the tenant for submetering, refer to the **Manager** for clarification, the Chief Engineer will be required to maintain meter readings for audit purposes.

Monthly Readings

Prior to conducting meter readings make sure all meters are identified. For example: electric meter on the 3rd floor located in the electric closet for XYZ Tenant would read:

XYZ - 3rd.FL.Ele.Cl.

Or a code system can also be set up using a meter log; Meter 1A-3rd. West, etc.

The Chief Engineer will be responsible for training all engineers on how to properly read meters and log entries.

Meter Reading Instructions

The Monthly Tenant Meter Reading form (refer to No. H, "Sample Forms", Form C3-1) must be used when conducting meter readings.

Read all tenant meters on the last Friday of each month.

1. For Line 1, enter meter reading for present month.
2. For Line 2, enter meter reading for the past month.
3. For Line 3, subtract Line 2 from Line 1.
4. For Line 4, combine total of all #3 lines.
5. For Line 5, enter the monthly KWH Cost.
6. For Line 6, enter the annual tenant meter total.
7. For Line 7, add all #6 lines.
8. For Line 8, enter the combined average KWH Cost of Line 5.

Monthly Billback

After taking each month's meter readings, transfer the readings onto the computerized program (refer to No. H, "Sample Forms," Form C3-2) and follow the instructions in the program. Refer all questions or problems to the **Manager** when using the program diskette.

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No. C • 4 Water Chilling Unit Readings (Logs)

Operating logs shall be maintained whenever operating personnel are on duty and available to record the readings. Recommended log interval is one hour, with three hours being the maximum. Operating logs shall include, as a minimum, the following information:

1. Condenser pressure
2. Condensing temperature
3. Condenser water supply and return temperature
4. Chilled water supply and return temperatures
5. Liquid refrigerant temperature
6. Evaporator pressure
7. Amps
8. Oil level
9. Oil temperature
10. Oil pressure.

Use of the water chilling unit manufacturer's standard log sheets are discouraged. Custom designed log format is recommended so that other applicable readings (flows, BTU meter readings, by-pass or back-flow volumes, etc.) may be recorded. (Refer to No. H, "Sample Forms," C-4, Chiller Log.)

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No. C • 5 Tenant Construction Procedures

The Chief Engineer will be responsible for assisting the **Manager** with enforcing the following guidelines for contractors working on the project.

Contractors' Rules and Regulations

1. Work Approval

   All drawings, subcontractors and materials must be approved through the Management Office prior to the start of construction. Contractor is to give a list of contacts' addresses and phone numbers for his or her company and for all subcontractors prior to commencement of work.

2. Permits

   Prior to commencement of work, the contractor is to provide a Certificate of Insurance to the owner with the limits of liability found in the Lease. Permits and licenses necessary for the onset of all work shall be secured and paid for by the contractors.

3. Building Use

   The contractor shall remain in the designated construction area so as not to interrupt other building tenants. Elevator use and large deliveries must be scheduled in advance with the Property Management Office.

4. Elevators

   All construction materials, tools and trash are to be transferred to and from the construction floor via the freight elevator. At no time shall the passenger elevators be used to move material, equipment, tools, or trash. The use of the freight elevator shall be scheduled by the Contractor. They may be required to share the freight elevator with the Building cleaning crew, other tenants, etc.

5. Non-Construction Area

   The contractor shall protect all walls, carpets, floors, furniture, and fixtures, and shall repair or replace damaged property without cost to the Property Management or Landlord. Masonite (or plywood) must be placed as a walkway on the public corridors from the elevator to the construction site and to the Public Restrooms to protect the carpet from drywall, etc. Common area carpet between job site and elevators must be vacuumed daily.

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No. C • 5 Tenant Construction Procedures

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6. Water and Electricity

Unless otherwise specified in the lease, water and electricity will be furnished in reasonable quantities for use in lighting, power tools, drinking water, water for testing, etc. On a case-by-case basis, these services may be billed-back to the General Contractor or appropriate sub-contractor. The contractor shall make all connections, furnish any necessary extensions, and remove same upon completion of work.

7. Dusty Work

Contractor shall notify the Property Management Office, prior to commencement of extremely dusty work (sheetrock cutting, sanding, sweaping etc.) so arrangements can be made to protect the filtering capacity on the affected HVAC equipment. Contractor shall absorb the cost to return the equipment to its proper condition.

8. Disposition of Materials

Any and all existing materials removed and not reused in the construction, except as directed by the Property Management Office, shall be disposed of by the contractor as waste or unwanted material. Contractor shall keep areas outside its demised premises free at all times from waste material, rubbish and debris; and shall remove all waste material, rubbish and debris on a daily basis. The contractor is responsible for scheduling its own trash pick-up. The building's dumpster shall not be used for construction debris unless approved by the **Manager**. Contractors/subcontractors are to use care and consideration for the other occupants, guests in the building when using any public area, i.e., bathroom, phone, etc.

9. Clean-up

Throughout the construction period contractor shall keep the construction area free of construction debris, trash and keep the floor in broom clean condition. Upon construction completion, the contractor shall remove all debris and surplus material and thoroughly clean the area.

10. Working Hours

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No. C • 5 Tenant Construction Procedures

No core drilling on concrete slab cutting shall occur during normal business hours. Contractor shall pay for an engineer to be available on overtime to oversee this type of activity. The Management Office reserves the right to determine what construction work is considered inappropriate for normal business hours.

General contractors must notify the Management Office of all after hours construction activity. A list of all after hours workers must be turned in by 3:00 P.M. for weekday work, at 11:00 A.M. Thursday for weekend work..

All construction workers arriving after hours Monday through Friday and all day Saturday, Sunday and Building Holidays must sign in at the security desk. Any worker whose name has not been included on the list will not be admitted unless vouched for by a construction superintendent. All workers must wear name tags identifying themselves and the company that they work for whenever they are on the project.

All work which requires the assistance of a building engineer will be arranged through the Management Office with 24 hours' advance notice. This type of work would include sprinkler work/fire pump shut down, fire alarm work, electric tie in's or short downs, plumbing riser shut downs, HVAC tie in's or shut downs. A request form has been attached to this document.

Contractors can check out keys for the mechanical and electrical room through the Management Office. A valid license must be left as a deposit to borrow this key.

11. Worker Conduct

Abusive language or actions on the part of the workers will not be tolerated. It will be the responsibility of the General Contractor to enforce this regulation on a day- to-day basis.

12. Posting of Rules and Regulations

A copy of these rules and regulations, acknowledged and accepted by the General Contractor, must be posted on the job site in a manner allowing easy access by all workers. It is the General Contractor's responsibility to instruct all workers including subcontractors to familiarize themselves with these rules.

13. Construction Inspections

Contractor is to do a thorough inspection of all common areas prior to construction to document any existing building deficiencies. Upon completion of work, contractor shall return these areas to the same condition in which they were originally viewed. Any damages caused by the contractor shall be corrected at the sole cost of the contractor.

14. Signage

Contractor or subcontractor signage may not be displayed in the building common areas or any of the window glass.

15. Parking

The loading dock will be used for loading and unloading. All contractors can make arrangements with the garage operator for daily parking. Any parking in rear of the building that is not authorized by the **Manager** will be subject to ticketing and towing.

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The Chief Engineer will be responsible for maintaining at all times the necessary amount of outside make-up to the HVAC system, as required by local jurisdiction codes and/or ASHRAE standards.

Equipment Room Ventilation

Volume requirements for mechanical equipment rooms are covered in ASHRAE Standard 15. The standard splits ventilation air requirements into two categories - natural and mechanical ventilation - based on the location of the equipment.

When a refrigeration system is located outdoors more than 20 feet from any building opening and is enclosed by a penthouse, lean-to or other structure, natural ventilation will be used.

The structure must not be connected to any occupied building by any means including: doorways, pipe tunnels or electrical conduit raceways, ventilation or ductwork.

The free-aperture cross section for ventilating the machinery room should amount to at least:

$F = G^{0.5}$

where,

F = the free opening area in square feet.
G = the mass of refrigerant in pounds in the largest system, and part which is located in the machinery room.

Most mechanical equipment room designs do not permit the use of natural ventilation. When the refrigeration system does not meet the requirements just described for a natural ventilation system, mechanical ventilation must be provided. According to ASHRAE Standard 15:

> *The minimum mechanical ventilation required to exhaust a potential accumulation of refrigerant due to leaks or a rupture of the system shall be capable of removing air from the machinery room in the following quantity:*

> $Q = 100 \times G^{0.5}$

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where,

Q = *the airflow in cubic feet per minute.*
G = *the mass of refrigerant in pounds in the largest system, any part of which is located in the machinery room.*

"Q" represents the minimum airflow that the ventilation system must be capable of providing while the equipment room is purged of refrigerants. According to Standard 15, it is not necessary to run the ventilation at this volume continuously, provided that:

> *...a sufficient part of the mechanical ventilation shall be operated to provide normal volumes equal to the larger of the following:*
>
> *a) 0.5 cfm per square foot of machinery room area; and*
> *b) operable if necessary for operator comfort, at a volume required to maintain a maximum temperature rise of 18° F based on all of the heat-producing machinery in the room.*

Thus, two distinct ventilation rates are defined for the mechanical equipment room. The first is continuous ventilation at a rate of 0.5 cfm per square foot (or more if excessive heat is produced in the room), and the second is the purge rate (based on mass of refrigerant in the refrigeration system). The standard can be met by providing continuous ventilation at the higher of these two rates; however, when the purge rate is significantly higher than the continuous ventilation rate, it may be desirable to use a fan system capable of operating at two distinct rates.

Multiple fans, multiple-speed fans or other modulation devices may be used if a two-tiered ventilation system is used. When the ventilation system is run at reduced airflow for continuous ventilation, controls must be provided to increase the ventilation rate to the purge rate (Q) when necessary. Automatic purge of the equipment room can be accomplished by linking the alarm output of a refrigerant (or oxygen) monitor into the ventilation system. When automatic purge is not employed, a switch to initiate purge ventilation should be located outside the main entrance to the mechanical equipment room (M.E.R.).

Sick Building Syndrome

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According to the National Institute of Occupational Safety and Health (NIOSH), employees suffering from poor air quality complain about one or more of the following***: eye irritation; dry throat; headache; fatigue; sinus congestion; skin irritation; shortness of breath; cough; dizziness; nausea; sneezing; and nose irritation.*** Usually these symptoms disappear after employees leave the workplace.

Most experts believe the likely causes of this so-called "sick building syndrome" are energy conservation measures compounded by poorly designed or maintained heating, ventilating and air-conditioning (HVAC) systems -- both of which help to trap contaminants indoors. But the physiological mechanism that produces symptoms remains a mystery.

When indoor air pollution sickens workers, testing of air samples may reveal concentrations of one of more that 600 specific air contaminants that are regulated by OSHA. The chemicals may be at levels known to cause illnesses. Consequently, the employer will take steps to bring the exposure to permissible levels.

However, in "sick" buildings, air sampling reveals the presence of hundreds of chemicals, but usually no one pollutant even begins to approach levels considered unsafe. Scientists suspect that this chemical soup composed of many pollutants is at the root of sick building syndrome.

Prevention

What can you do about ventilation-related problems? Maintain your HVAC system on a regular basis and boost the volume of fresh outdoor air that comes into your facility.

- Maintaining Your HVAC System

  Heating, ventilating and air-conditioning (HVAC) systems can be the source of air quality problems when they are poorly designed or improperly operated and maintained. For instance, water collecting in a poorly designed or maintained system can become a breeding ground for biological contaminants, such as mold spores, bacteria or viruses. The HVAC system may then disseminate these contaminants throughout the facility, causing building-related illnesses.

  Since your HVAC system itself can be the cause of indoor air problems, you should see that the system is being properly maintained. You want to make sure that fresh air is not contaminated before it's circulated to workers.

Inspect the system on a regular basis. Take a look at coils, drain pans, ductwork, and similar areas for mold, mildew, standing water, and other biological contaminants. Be sure to change filters in an air-filtering system to prevent dust and biological contaminants into the air.

- Increasing the Volume of Fresh Air

  An inadequate supply of fresh outside air can also cause problems. A poorly designed system may be unable to supply enough fresh air. Or an adequate system may be operated at a low volume or velocity. This lack of proper ventilation may allow many chemicals to build up to the point where no single chemical reaches unsafe levels, yet the sum creates discomfort, lethargy, and low employee productivity.

  In many cases, you can correct indoor air problems by increasing the outside airflow into your facility. To determine how much fresh air you need, you should look to the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE). This industry association publishes advisory standards known as voluntary consensus standards. These standards are designed to improve "comfort" and to avoid any adverse health effects.

IAQ Guidelines

ASHRAE defines good indoor air quality as "air in which there are no known contaminants at harmful concentrations and with which a substantial majority (80 percent) of people exposed do not express dissatisfaction."

In 1989, ASHRAE drastically revised its 1981 standards, which had called for a minimum of 5 cubic feet per minute of outdoor air per person (5 cfm/person) in nonsmoking areas. Today, the organization recommends a minimum of 15 cfm/person, and it suggests even greater volumes of fresh air depending on the work environment.

A key piece of evidence that persuaded the society to make the change was a four-year study of acute respiratory diseases among thousands of U.S. Army recruits. Soldiers housed in modern, energy-efficient barracks caught the flu far more often than those living in older, unsealed barracks.

ASHRAE's updated ventilation standard (consensus number 62-1989) is known as Ventilation for Acceptable Indoor Air Quality. This voluntary standard recommends the following ventilation rates:

- At least 15 cubic feet per minute of outdoor air per person (15 cfm/person).

- At least 20 cfm/person in laundries.
- At least 20 cfm/person in the typical office setting within an industrial facility if the office is protected from processes within the plant.
- At least 30 cfm/person in bars and cocktail lounges.
- At least 60 cfm/person in workplace smoking lounges.

Of course, if contamination from any processes within a facility dominates a work area, OSHA standards - such as the permissible exposure limits - take over.

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No. C • 7 Elevator Safety

In order to maintain elevator safety, it is imperative that under no circumstances is anyone to attempt to force the elevator doors open to rescue trapped passenger(s) off any elevator.

When this type of emergency occurs, contact the Chief Engineer, Management and Security with information on the elevator entrapment, location and elevator number during normal business hours. Management will contact the elevator service contractor immediately; then contact the Chief Engineer with appropriate information.

Once Management and/or the elevator contractor has been contacted, maintain communication with the passenger(s) on the elevator to keep them "calm."

After the trapped passenger(s) is rescued, fill out and submit the necessary "Event Report." Refer to No. H, "Sample Forms", A9, "Event Report" form.

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No. C • 8 Winterization Procedures

The Chief Engineer will be responsible for developing a Winterization Procedures Manual for each designated project.

Manual Contents Guidelines

- Winterization Procedures - Procedures should include the time frame and sequence of steps and inventory with implementing the program.

  Following are the winterization procedures being performed annually:

  1. Energize and verify the operation of the cooling tower sump heaters in October. Set thermostats at 45°-50° degrees Fahrenheit.
  2. Energize all VAV heaters as weather permits. The 1st floor VAV and baseboard heaters are usually on by the end of September due to the large window areas and tenant comfort. All VAV heaters should be activated by November.
  3. Energize all stairwell, storeroom, deck and mechanical room cabinet heaters by November.
  4. Drain all drip legs on the garage dry pipe sprinkler system from October through to March.
  5. Energize and check the operation of all piping with heat tape by November.
  6. Drain the courtyard fountains by November, depending on the weather conditions.
  7. Verify the operation of the night setback thermostats in December.

Snow Removal Procedures

In October of each year the following will be conducted:

- Preventive Maintenance on snow blower;
- Check inventory and order salt; and
- Check inventory of snow shovels.

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All engineers are to monitor weather reports if it snows at night. If the accumulation is two inches or less, the start-up engineer and the assistant engineer will report to work at 6:00 A.M. If there are more than two inches accumulation, all engineers will report to work at 6:00 A.M.

- All engineers are to take weather and road conditions into consideration and allow ample travel time from their homes in order to arrive at work at the designated time.

If it should snow heavily during the course of a work day, continuing into the night, some or all engineers will be required to remain overnight. Extra engineers will be called in if it snows heavily on a Saturday. The Saturday engineer will make the decision after evaluating the snow conditions. All of the above decisions will be communicated to the Chief Engineer and Assistant Chief Engineer and be subject to approval by the **Manager**.

Snow Route Plan

Using a copy of the project's "Ground Floor" building plan (Architectural) highlight the Primary access areas to be cleaned first in (Yellow) and the Secondary access areas to be cleaned in (Blue).

Primary Area: These areas allow free passage to and from the Main pedestrian and parking entrances of the building.

Secondary Areas: These areas allow free passage to and from all entrances and provide a clear path around the perimeter of the building.

Circuit Charts

Provide a copy of the electrical circuit chart, identifying the breaker panel, serving the heat tapes, location of the VAV duct heaters, sump heaters, etc.

Hose Bibs

The manual should include valve charts and building floor plans, identifying the location of the hose bibs and shut off valves.

HVAC

The manual should include procedures with start-up procedures with boilers, heat exchangers, free cooling, cooling towers, etc.

Drip Legs

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The manual should include a schedule of when the garage dry pipe sprinkler system drip legs should be blown down for condensation build-up.

Starting in October, the drip legs should be drained monthly and weekly once the temperature drops to 28°F or below until March of each season.