

## **CONSTRUCTION PROCESS TERMINOLOGY**

### **1. SITE DEVELOPMENT**

#### **IMPORTANT SITE CONSIDERATIONS**

##### *REMEDIAL TECHNIQUES*

**FILLING-** if the shallow upper levels of soil or an insolated pocket or pockets of soil contain too much organic material to support a structure or contain other soils with undesirable characteristics, they can be excavated and replaced with more suitable soils which are compacted in 6" layers until they exceed 98% of the density of virgin soil.

**CUTTING AND FILLING -** Leveling a site by cutting down the high part of the site and filling the lower part until a level pad is achieved.

**SURCHARGING -** Compressing a soil until it is dense enough to support the weight of a building by placing fill or debris on the site and waiting until the desired compression is obtained. The more weight, the less time is needed. Only suitable where there is adequate time (9-18 months is not uncommon).

**PILINGS -** if the soil is not of sufficient strength for load bearing of the building, or if the building is over several stories, pilings are common; pilings can be of wood poles, cast concrete poles, steel pipe, or steel H-beams; they are typically driven into the ground by a noisy steam powered hammer mounted on a crane; occasionally, they are placed into holes drilled by a crane-mounted earth drill, then backfilled with concrete; once the piles are driven, they are cut off to equal, level height and capped to form a foundation; the number, type, and depth of pilings are dependent upon the size and type of building and soil conditions as determined by the project engineer.

#### **ENVIRONMENTAL CHARACTERISTICS**

**BROWNFIELDS-** The redevelopment of contaminated sites. Many states are encouraging this and have developed programs to encourage the redevelopment of such sites especially in urban areas with both incentives and protection for the developers.

**WETLANDS-** These are defined by soil conditions, as well as fauna and flora and protected by the Federal Government under the Clean Water Act as well as by state legislation.

**FLOOD PLAINS-** These are defined by Federal Maps. Development in the Floodway is prohibited. Most areas have minimum elevations above the 100 year flood plain and some have “no net fill” regulations to prevent the importation of fill into a flood plain.

**BIOFILTERS** - a portion of the landscaping dedicated to cleaning impurities (such as phosphorus from yard fertilizer) from the storm water prior to releasing into the storm water system, typically of grass lined swales or stream beds which contain water only for brief periods after rainfall; impact to project costs due to a) dedication of land for them and b) construction cost.

**RETENTION AND DETENTION FACILITIES-** Containment areas designed to prevent the flow of water off the site after development from exceeding the flow of water prior to the development. Size varies with the amount of impervious surface and is impacted by the water table. In areas where the water table is high, these facilities can impact a substantial amount of the site since they must be shallow and cannot be below the natural water table to be effective.

## **2. FOUNDATIONS**

**FOOTING** - lowest portion of a foundation wall support below ground level; must be below the “freeze line”.

**FOUNDATION WALL** - portion of wall below ground level which supports a building’s exterior wall. It is usually made of either concrete or 12” block filled with concrete and reinforced.

**RETAINING WALL** - a structural wall built to hold the earth in place when there is a difference in elevation or to keep water from flooding.

**COURSE** - a layer of block or brick.

**BLOCK REINFORCING** - wire or reinforcing steel (rebar) laid in mortar between courses to reinforce wall; reduces cracking.

## **3. STRUCTURAL SYSTEMS**

**BOX ON BOX** - office portion of a building with low roof, attached to industrial portion with high roof; reduces construction cost if office is large enough. Hurts flexibility.

**LEVEL ROOF HEIGHT** - office roof and factory roof at same height; flexible for expansion of office portion of building into factory portion; suitable for smaller offices and lower buildings. Also works well with buildings which are 26 feet and

higher where offices can be placed on a mezzanine level.

**INDEPENDENT STRUCTURAL FRAME SYSTEM** - structural steel roof support that is free standing, i.e., independent of walls; opposite of a wall bearing system.

**WALL BEARING SYSTEM** - exterior walls supporting roof; opposite of structural frame system.

**PREENGINEERED OR MANUFACTURED BUILDING**- buildings built by firms such as Butler or General Steel. Exterior is often metal, but can be of any material. Roof line is peaked.

**BAR or TRUSS SHAPES** - shapes fabricated from various rolled pieces to create a load bearing system.

**METAL ROOF DECK** - ribbed metal supported across roof joists and girders, onto which installation and roof material are laid.

**COLUMN** - vertical structural, in the form of an "H", used to support a roof or floor structure; round, square or wide flange.

**ROOF GIRDER** - horizontal main member to support roof joists.

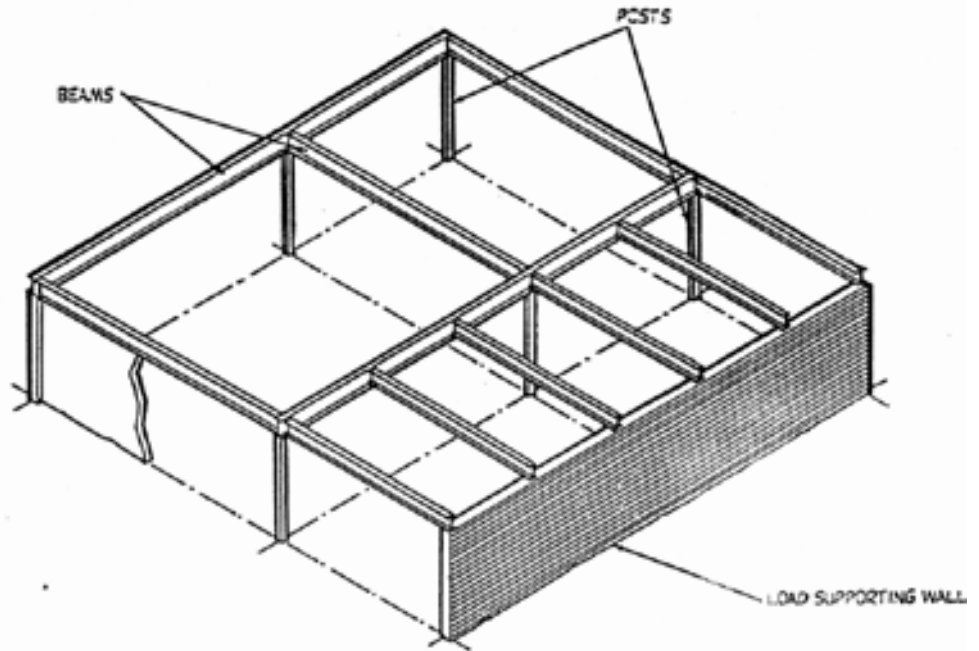
**ROOF JOIST** - horizontal minor member to support roof deck.

**CANTILEVER FRAMING** - structural steel or concrete design system that takes advantage of "seesaw" balancing of members to reduce size or weight of steel frame or concrete.

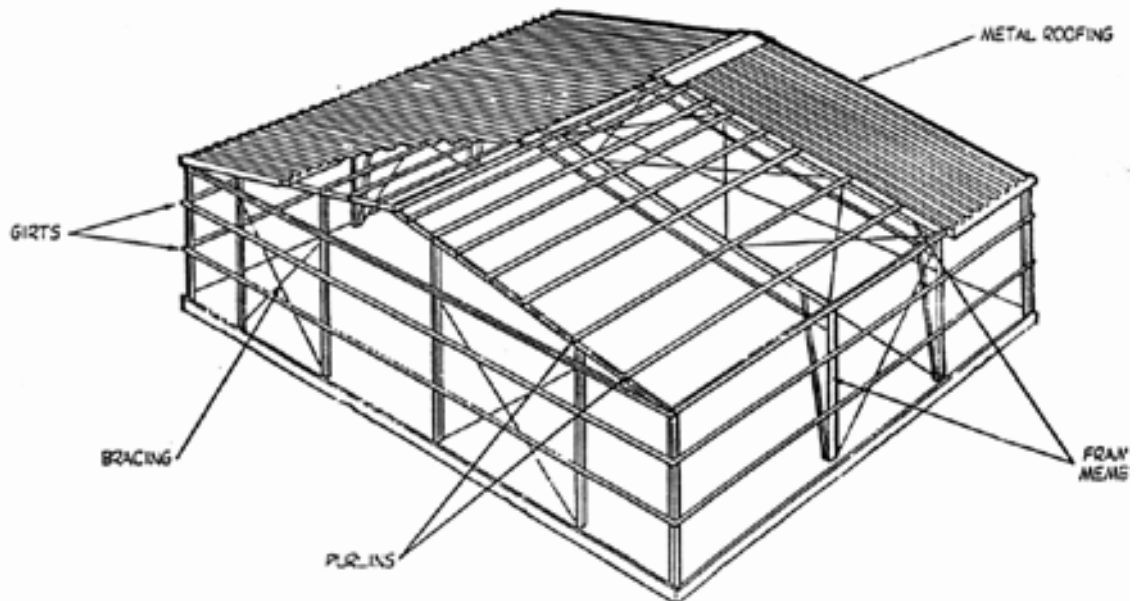
**LINTEL** - horizontal beam or girder over a window or door opening to support the structure above.

**I BEAM** - structural shape in the form of an "I"; narrow flange is used horizontally to support roof deck or upper floor slab.

**LOAD SUPPORTING WALL,  
POSTS & BEAMS**



**PRE-ENGINEERED STEEL FRAME**



#### **4. EXTERIOR**

**SHELL** - structural framework of a building.

**STOREFRONT** - extruded aluminum frames and doors, usually used as an entry feature of tenant space.

**BERM** - landscaped earth sloping from the ground to an exterior building wall.

**CAVITY WALL CONSTRUCTION** - 1.5 to 2 inches of air space provided between face brick and block; provides insulation and prevents water penetration.

**STACK BOND** - decorative arrangement of block and brick; vertical joints are continuous rather than staggered.

**BOND BEAM** - block filled with concrete and reinforcing steel (rebar) used to create a rigid wall.

**CONTRACTOR OR EXPANSION JOINT** - opening between two independent parts of a wall, floor, sidewalk, or roof system to allow for contraction or expansion; covered with flexible waterproof material; generally installed every 20' along vertical walls and every 200' on roofs.

**SPLIT BRICK or BLOCK** - decorative rough textured concrete block or brick.

**CONCRETE BLOCK** - building block unit of gravel and concrete; 8" high by 18" wide; also known as "CMU" (Concrete Masonry Unit).

**METAL SIDING** - steel or aluminum pre-painted wall; ribbed for rigidity; can be insulated or un-insulated.

**PRECAST DOUBLE TEE** - concrete wall or floor unit panels cast offsite with deep ribs for structural support.

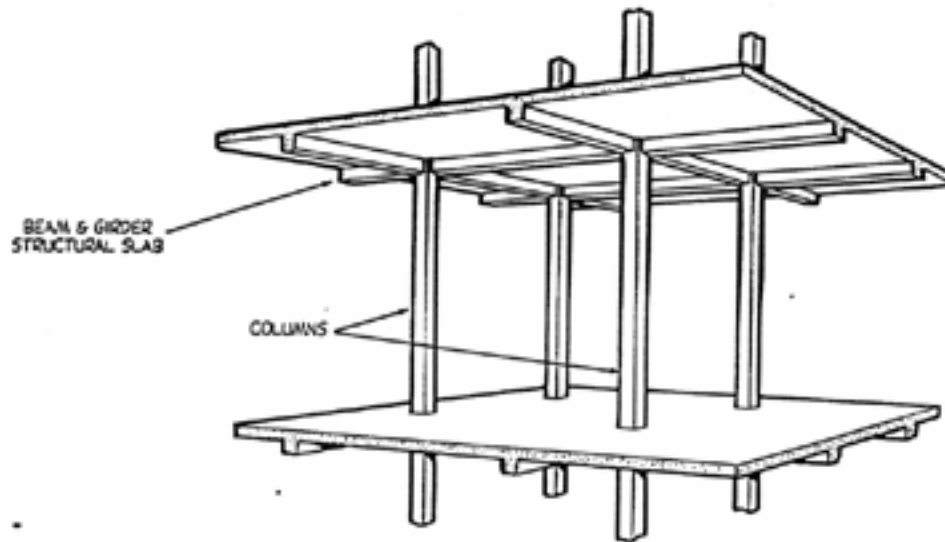
**CURTAIN WALL** - glass and anodized aluminum frame wall.

**REFLECTING GLASS** - light reflecting and/or heat radiation blocking surface for reduction of heat and/or light from sun; "low E" coating common to reduce heat radiation.

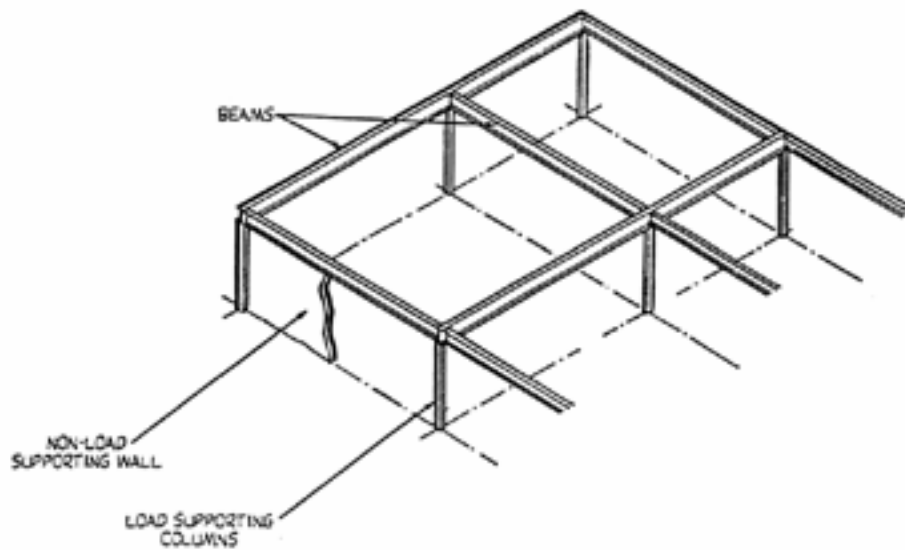
**AGGREGATE FACING** - decorative finish on concrete, plaster, plywood, etc.

**SOFIT** - the underside of any portion of a building, such as a staircase, protruding wall, eave, etc.

**REINFORCED CONCRETE FRAME**



**STEEL FRAME**



**CONCRETE TILT-UP WALL** - concrete wall panels approximately 6" in depth cast on top of the floor slab on site, then tilted into place after 7 to 14 days with a crane; panels are welded together and joints are caulked.

**SPANDREL PANEL** - a glass panel; often opaque, connecting area between two windows, across structural wall or columns; when installed, provides appearance of continual horizontal glass band from the exterior.

**DRYVIT** - a proprietary product often used to describe a generic product type; a rigid styrofoam insulating material is glued onto plywood or exterior sheetrock, then a thin coat of plaster is skimmed with a trowel over the top of the styrofoam, then paint applied; Dryvit's advantages include low cost and the ability to cut the styrofoam into many shapes providing reveals or custom shapes; a disadvantage of Dryvit type exterior is it must be repainted more frequently than many materials.

## **5. CONCRETE SLAB and FINISHING**

**STRUCTURAL SLAB** - ground level concrete slab supported from piles or columns as if it were an upper floor; required in poor soil conditions.

**SLAB ON GRADE** - ground level concrete slab supported by compacted rock on top of the soil on which it rests.

**CONCRETE MESH** - 6" x 6" wire mesh used in slab on grade to reduce cracking and warping; does not provide structural support.

**CONCRETE FINISH** - careful process of floating, waiting for concrete to set, and fine trowelling to produce a hard, dense, wearable surface finish on placed concrete.

**CONSTRUCTION/CONTRACTION JOINT** - generally a saw cut or sheet metal strip to separate sections of floor to control where floor cracks; as concrete hardens, it shrinks, creating stresses which are reduced by cracking. Cuts vary but are usually 1200 square feet.

**LASER SCREED** - a device which establishes a grade by laser. Disperses concrete by auger, vibrates and consolidates the concrete. It maintains the grade by monitoring the screed elevation at a rate of 5 times a second. The flatness produced is 0.25 inches over a length of 50 feet versus .75 inches for a manually screed floor.

## **6. ROOFING**

**ROOF DECK** - roofing materials come in a variety of types, including metal deck, gypsum deck, wood fiber, cement (tectum), precast concrete plank or beams.

**GYPHUM ROOF DECK** - gypsum "concrete" poured onto sheetrock or fiberglass formboard and used as roofing material.

**INSULATION** - material designed to inhibit the flow of heat or cold into or out of a building; comes in various forms including noncombustible (fiberglass, Fesco, Celotherm -- perlite) and combustible (Celotex, wood fiber); rigid insulation installed above roof decking and non-rigid often below decking (such as fiberglass batts).

**EXPANSION JOINT** - opening between two independent parts of a roof deck that allows for expansion; covered with flexible waterproof material; there should never be an expanse more than 200 feet wide without an expansion joint.

**PARAPET** - portion of exterior or interior wall extending above or through roof deck.

**FLASHING** - any waterproofing between a roof deck and a vertical surface such as a parapet, equipment, curb support, etc.

**COPING** - concrete plank or tile laid on top of a parapet to prevent entrance of water.

**SCUTTLE or HATCH** - opening (usually 3' x 3' or 3' x 6') with lid to permit access to roof from an interior ladder.

### **ROOF TYPES**

#### **BUILT UP**

#### **MODIFIED BITUMEN**

**SINGLE PLY/MEMBRANE ROOF**- a roof covering made sheets of rubber or pvc compounds which lies over a coping sheet and insulation and can be attached to the roof deck in a variety of ways.



**METAL ROOF**- a manufactured roof cut into sheets which can be laid over a steel substructure, wood, or other materials. Panels are “crimped” together with a clip and can be insulated in a variety of methods.



**BERKELEY ROOF** - a wood frame roof system characterized by plywood sheathing over 2x4 or 2x6 wood purling supported by glulams or trusses, often the plywood sheets and 2x4 or 2x6 are pre-fabricated on the ground and then lifted onto the roof in panels.

## **7. LOADING FACILITIES and HANDLING**

**LOADING DOCK WELL** - inclined; building at outside grade level but “dug out 48” at loading area to accommodate trucks; requires storm drain at bottom.

**DOCK HIGH LOADING – (TAILGATE LOADING)** area of a building where trucks pick up and deliver materials built at truck-trailer most common loading desired for industrial buildings.

**INSIDE DOCK HIGH LOADING**-dock high loading design so that the entire truck is inside the building when backed against the loading area. Used in liquor, pharmaceutical and electronics distribution facilities.

**GRADE LEVEL LOADING – (DRIVE IN)** an area of a building for pick up and delivery of materials, generally at ground height allowing vehicles, forklift and hand trucks to be driven in and out of the building.

**COMPACTOR** - rubbish disposal container and compressing unit used to pack rubbish in container.

**LOADING DOCK SHELTER** - enclosed space between rear sides of truck and dock opening to eliminate cold drafts

**LOADING DOCK LEVELATOR** - bridges the space between a dock and a truck floor; adjusts in height by electrically controlled hydraulic cylinders; rated for capacity in lbs.

**DOCK PLATE**- A hinged metal plate which is attached to the outside wall of the building just under the door opening and lifted up and placed on the floor of a truck. Cheaper and less functional than a mechanical levelator.

**DOCK LOCK**- A safety device which locks the trailer to the building.

**DOCK LIGHT** - a light mounted on short boom adjacent to loading door, to shine in to open truck so loading crew can see better.

**PALLET** - wood, metal, or plastic movable platform used to support goods while being transported by a lift truck.

**PALLET RACK** - structural beams and columns used to support pallets above floor level.

**LIFT TRUCK** - electric, gas, or gasoline powered equipment used to transport and lift pallets.

## **8. SPRINKLER SYSTEMS AND FIRE PROTECTION**

**SPRINKLER SYSTEM** - a network of pipes, risers, mains, valves, and sprinkler heads throughout a building that spray water in the event of a fire; can be initiated by automatic heat or smoke sensors or manually.

Types (generally associated with water based sprinkler systems and their hydraulically calculated off-shoot):

1. **Anti-freeze systems** – a sprinkler system where antifreeze has been added to the water in the system to prevent freeze-up. Easy to install, difficult to maintain.
2. **Hydraulically calculated sprinkler system** – a sprinkler system installed based on a set of calculations which indicate that the system will function properly in the most remote areas of the building. Well worth doing in larger facilities – savings based on materials and installation.
3. **Deluge system** – open sprinkler heads attached to piping which only receives water when a detection device located in the same area as the deluge system is activated. When activation occurs, ALL sprinkler heads discharge water.

4. Dry pipe system – a sprinkler system filled with pressurized air. When a sprinkler head is activated, the air leaks out of the system and water is allowed in through the main valve. Generally used in cold or unheated applications.
5. Pre-action system – a sprinkler system filled with air (may or may not be pressurized) which also requires the activation of a detection device in the same areas as the sprinkler system. Generally used in high cost exposure (not high hazard) areas. This system gives the tenant or building owner a limited opportunity to evaluate the condition and possibly shut off the water supply in the event of easy containment or false alarm.

**WET SYSTEM** - the most common type of sprinkler system, wherein the pipes contain water that sprays out of the heads immediately upon tripping.

**DRY SYSTEM** - used in cold climates, particularly in large warehouses which do not need to be heated, otherwise the pipes are filled with compressed air, which of course will not freeze; once a head is tripped, the air escapes first, followed by the water which had been held back by the compressed air; sometimes a mixed wet and dry system is used, wherein only outdoor pipes under loading awning or overhang are dry.

**POST INDICATOR VALVE** - vertical valves located at yard mains or branches into building

**SPRINKLER SERVICE and VALVES** - large water supply from water main or storage tank for fire fighting purposes; riser pipes are generally 6-8" or larger; rated by flow and pressure.

**YARD MAIN** - sprinkler private water main located at perimeter of a building.

**LOOP MAIN** - yard main around entire perimeter of a building.

**WALL INDICATOR VALVE** - valve on building wall which locates sprinkler main in a building.

**FIRE PUMP** - electric or diesel engine-driven pump to boost sprinkler water pressure within a building; required for most ESFR systems.

**SPRINKLER SYSTEM STORAGE TANK** - second source of water supply for high dollar valuation risks in remote areas.

**SPRINKLER MAIN** - a large pipe within a building from the sprinkler service riser to distribute sprinkler water throughout a building.

**SPRINKLER BRANCH** - a small pipe with a sprinkler head that is fed by the sprinkler main.

**SMOKE AND HEAT VENT** - roof vent to allow heat and smoke to escape from a building; temperature activated with heat sensitive fused link.

**DRAFT CURTAIN** - vertical panel from roof deck to prevent fire heat from spreading across ceilings and activating too many sprinkler heads.

**FIRE DOOR** - insulated door with Underwriter's Laboratory hourly rating; used to inhibit the spread of fires.

**FIRE WALL or PARTITION** - sheetrock or masonry wall used to separate "fire areas" within a building.

**FIRE DEPARTMENT STANDPIPE CONNECTION** - pipe to which fire department connects its equipment to sprinkler service of a building.

**ESFR SYSTEM** - a special sprinkler system designated Early Suppression Fast Response; uses high temperature heads, larger pipe size and higher pressure so more water volume is released in order to quickly suppress the fire; permits storage of materials to greater heights of racking and/or more flammable and combustible materials.

**LOW TEMPERATURE HEADS** - most sprinklers are activated by temperatures exceeding 165<sup>0</sup>F.

**HIGH TEMPERATURE HEADS** - insurance companies prefer high temperature heads which are activated at over 286<sup>0</sup>F; water damage is reduced because fewer heads are triggered; changing from low to high temperature heads may permit higher rack storage and/or flammable materials.

**RATED CORRIDORS** - in some instances, the exiting corridors for office space must be "rated" with fire resistant materials; a one-hour rated corridor must have at least one layer of sheetrock, doors which have a one-hour UL (Underwriters Laboratories) rating and clips to hold the ceiling tile down to prevent spread of fire into the plenum; sometimes rated corridors also require special smoke detection systems; a two-hour rated corridor requires two-hour label doors and at least two layers of sheetrock.

**DEADEND CORRIDORS** - the Universal Building Code (UBC) requires that a corridor cannot have a dead end over 30' in length.

**FIRE EXITING** - the UBC and fire marshals have special exiting requirements for office space, a few of which follow:

- A space over 3,000 sq. ft. requires at least two exits.
- A space with an occupancy load, (the number of people which could be accommodated in the facility at peak demand) in excess of 10 often requires second exit.
- In the case of a second exit requirement, the two exits must be separated by a distance of at least 50% of the longest diagonal distance across the space.

## **9. DRAINAGE**

**INTERIOR ROOF DRAINAGE** - roof drainage from interior portions of roof with interior piping to pavement or storm systems; often cast iron so trickle of rain water in drain doesn't bother office tenants.

**EXTERIOR ROOF DRAINAGE** - roof drainage by downspouts on building perimeter with leaders on exterior wall to pavement to storm system.

**PERIMETER DRAINS** - placed underground adjacent to foundation walls to drain away storm water prior to its penetrating the building walls or floor slab; typically of corrugated plastic flexible pipe with perforated holes, and buried in crushed rock which permits water to flow through but will not plug holes.

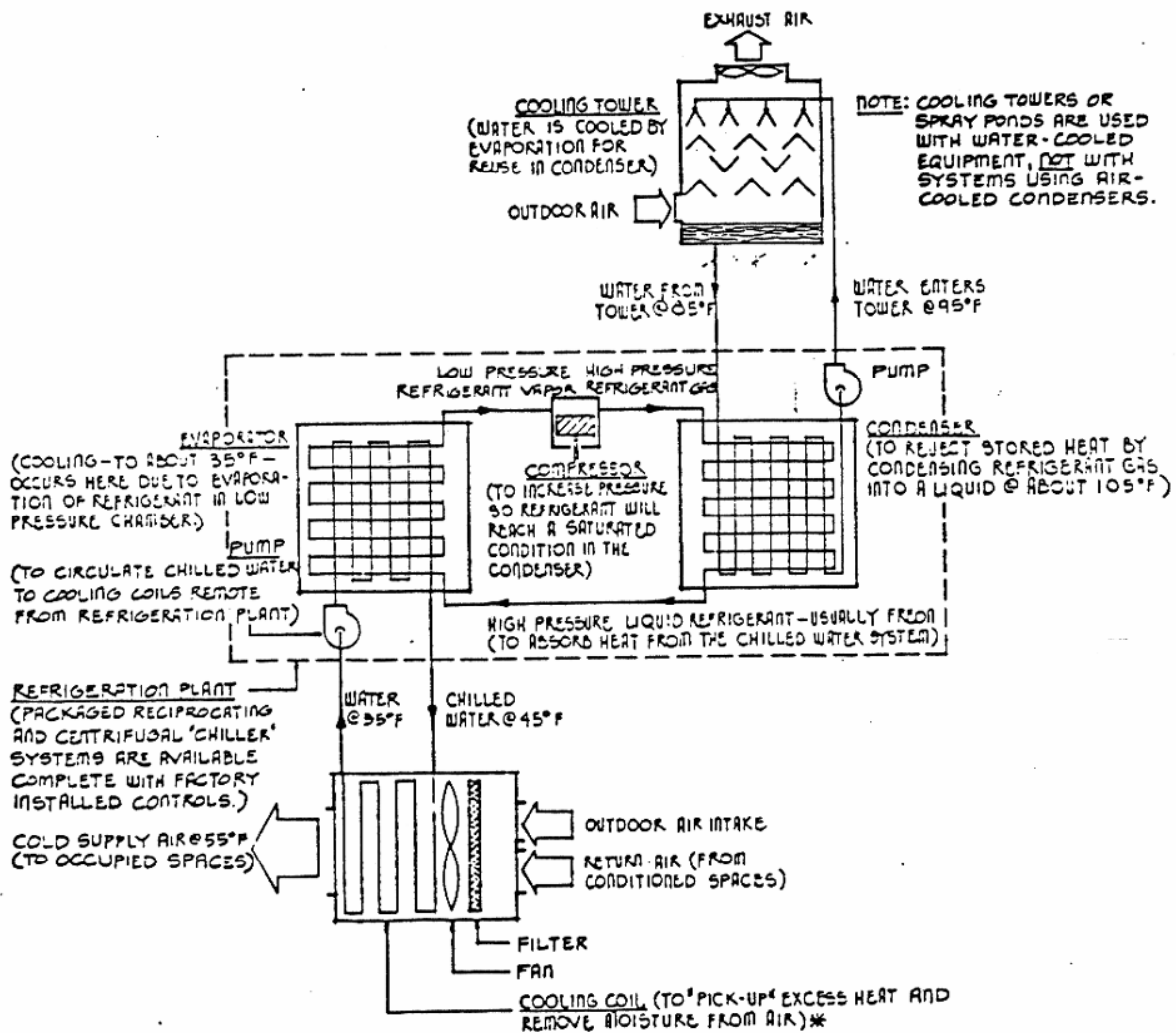
**SCUPPER** - overflow drain through a parapet.

**STORM SEWER** - usually separated from sanitary sewer, for use by rain water from building roof, parking lot and landscaping. This will be a major area for future environmental regulations.

## 10. HEATING, VENTILATION, and AIR CONDITIONING (HVAC)

### MECHANICAL SYSTEMS—COOLING: COMPRESSIVE REFRIGERATION CYCLE

The process of removing heat from interior spaces to the outdoors is based on the principle of thermodynamics that heat will move to a cooler medium. Cooling by mechanical compression is shown by the diagram below. Heat is transferred from the chilled water system (See evaporator-cooling coil cycle) to the condenser water system (See condenser-cooling tower cycle) by means of changing the state of a refrigerant (See Freon compressor cycle) which gives off and absorbs heat.



\* THIS PROCESS IS SIMILAR TO WHAT NORMALLY OCCURS IN NATURE. FOR EXAMPLE, WHEN A WARM-AIR MASS MEETS A COLD FRONT THE AIR IS COOLED AND LOSES ITS CAPACITY TO HOLD MOISTURE. AS A CONSEQUENCE, THE MOISTURE CONDENSES AND FALLS AS RAIN.

**AIR HANDLER** - blower to move conditioned air.

**DIRECT EXPANSION SYSTEM** - air conditioning in which cooling is achieved by direct use of freon gas in cooling coil.

**COMPRESSOR** - equipment to compress freon after it has expanded and cooled the coil in order to recycle the freon.

**CONDENSING UNIT** - air cooled outdoor air conditioning equipment in which the compressor is located.

**DUCTWORK** - conduits that distribute cooled or heated air throughout a building.

**DUCTED RETURN** - most HVAC systems provide ducts for flow of supply air into a room; a ducted return system also provides a duct for the HVAC equipment to suck air out of each room.

**PLENUM RETURN** - a plenum return system does not have ducts sucking air from each room, but rather from the plenum space (area above the ceiling tile and below the roof) which in turn is vented from diffusers in the ceiling tile; the advantage of this system is it costs less since individual ducts are not installed, but may have a disadvantage of requiring the tenant to provide plenum rated telephone and cabling wire which decreases the chance of fire spreading within the plenum area.

**ECONOMIZER CYCLE** - system of controls and ducts that use cool outside air for "free cooling" of warmer inside air.

**REGISTER** - outlet for air from duct.

**DIFFUSER** - outlet to mix air from duct with room air; generally has a vertical blow.

**CHILLER** - freon compressor or steam absorption equipment to produce chilled water at 45 degrees F for use in air conditioning system.

**DAMPER** - controlled louver in a wall or duct to vary the amount of air in a cooling or heating system.

**ROOF TOP SYSTEM** - complete system including cooling equipment, heating equipment, compressor, and blower in one roof unit; often called packaged unit, or "gas pack".

**UNIT HEATER** - large roof hung or floor mounted heater, typically found in warehouses and factories, that heats large open areas; burns oil or natural gas.

**HEAT PUMP** - a heat pump is electric powered heating and cooling system; the electrically powered compressor pump removes heat from the outside air so it can be transferred to the indoor space; conversely, the heat pump can remove heat from the indoor air to provide cooling and transfer the heat to the outdoor air; some heat pump systems exchange heat with water versus outside air, so-called hydronic loop systems; heat pump systems are not the most efficient type for heating, but have the advantage of providing both heating and cooling with electricity only.

**HOT WATER HEATING SYSTEM** - utilizes a boiler to generate hot water, a pump to circulate the water, and a unit heater with fan and coil to heat air or baseboard; uses two pipes with air vents on the upper pipe only.

**STEAM HEATING SYSTEM** - a two pipe heating system that uses steam from heated water to heat the air; system air vents are on the lower pipe only.

**GAS HEATING SYSTEM** - heating system that burns natural gas to heat air in a building; uses one pipe only with a flue through the roof.

**COIL (WATER or STEAM)** - small piping with aluminum fins that transfer heating or cooling from water running through the pipes to the air.

**PERIMETER BASEBOARD HEAT** - at the bottom, or base of walls; used generally in offices to heat cold air dropping down from cold glass or exterior walls.

**FRESH AIR MAKE-UP** - heated outside air that replaces air exhausted from space by spray booths, exhaust hoods, gas water heaters, and fans.

**ROOF FAN** - fan on roof used to exhaust summer heat.

**PROPANE** - liquid petroleum gas (LPG) used as a substitute for natural gas.

**TON** - a measurement of cooling. Often 300 to 400 sq. ft. of office space can be cooled by one ton of air conditioning.

**VARIABLE AIR VOLUME** - a variable air volume (VAV) box is located within ducting close to the offices supplied on a single thermostat/zone; a VAV box regulates amount of cold air called for by thermostat for a particular zone; often has a reheat feature by electrical strips to enable one zone to be heated while other parts of the building are cooled.



## 11. ELECTRIC SERVICE, DISTRIBUTION, and LIGHTING

AMPERAGE (AMPS) = "A" - quantity of electricity (electrons) flowing; *using a water bucket analogy, the size of the water pipe filling the bucket*; WATTS / VOLTS = AMPS

VOLTAGE (VOLTS) = "V" - measure of electromotive force; pressure causing amperes of electricity to flow; *using a water analogy, the pressure of water from a faucet on its way into a bucket*; WATTS / AMPS = VOLTS.

PRIMARY SERVICE VOLTAGE - voltage from electric power company street distribution lines; "high voltage" is typically 13,200 volts.

SECONDARY SERVICE VOLTAGE - voltage provided for actual use to operate electrical equipment and lights within buildings; typically 460-480 for large modern buildings, 208-220-240 for smaller buildings, and 110-120 for house and office use in normal receptacles.

WATTAGE (WATTS) = "W" - measure of electrical power; 1 watt of power is consumed when 1 amp of current flows through 1 ohm of resistance (ohm is the unit of measure for resistance); *using a water bucket analogy, the flow of water (combination of pipe size and pressure) into a bucket*; AMPS x VOLTS = WATTS.

KILOWATT (KW) - equal to 1000 watts.

KILOWATT DEMAND - maximum electric power required during a specific period of time; *using a water bucket analogy, the greatest number of buckets that are filled during a specific period of time.*

KILOWATT HOURS (KWH) - measure of actual amount of electricity used; *using a water bucket analogy, how many buckets are filled during a specific period of time.*

KVA - kilovolt amperes; there are two forms of power (1) real =  $KW^2$  and (2) reactive =  $KVAR^2$ ; for example, in a glass of beer, the liquid is real and the foam is reactive; generally, real power is about 75% of the total power and reactive power is about 25%;  $KVA^2 = KW^2 + KVAR^2$

**PHASE (f)** - denotes type of electrical system in a building.

three phase service - motors above 3/4 HP generally operate on 3 phase electric current; e.g., 240v, 480v.

single phase service - smaller electric motors and lighting systems operate on single phase current; e.g., 120/240v 1f 3w (one phase, 3 wire)

If there is one more wire than phases; that is the neutral. In a three phase service, there is a given voltage between line and line and also between line and neutral, e.g., line and line: 240, 208, 480; line and neutral: 120, 277

**SERVICE FEEDER** - electrical feeder and conduit from transformer to buildings; 4" diameter pipe allows 300-400 amp cables.

**TRANSFORMER** - equipment which changes voltage up or down as required through magnetism; rated KVA.

**POLE TRANSFORMER SERVICE** - service from electric power company in which 1 to 3 pot transformers are located on a pole near the street; generally a relatively small size service, up to 600 amps.

**MAT TRANSFORMER SERVICE** - metal cabinet type transformer, located on the ground near a building.

**PAD TRANSFORMER SERVICE** - 3 separate pot transformers of relatively large size, located on the ground.

**LOCAL TRANSFORMER** - transformer in a 480v system that reduces local voltage to 120v, 208v, or 277v as applicable.

**SERVICE SWITCH** - 1 to 6 (maximum) switches connected to the electric power company feeders or transformer to connect and disconnect service; sometimes called "disconnects."

**CURRENT TRANSFORMER (CT) CABINET** - electric service equipment on which power company mounts its current transformers and connects its meter; one square inch of copper buss provides 1000 amps.

**MAIN DISTRIBUTION PANEL** - electrical switching panel at service to control feeder cables throughout a building; the panel may also consist of service switches.

GFI - ground fault interrupted; an electrical outlet specifically designed to “trip” at the first indication of a short circuit to protect against electrical shock or damage to electronics.

LOCAL PANEL - switch panel controlling power or lighting in a section of a building.

STARTER - relay to control electrical motor operation.

BUSS WAY - long piece of overhead electrical panel with switches to connect to local equipment.

CORD DROP - flexible rubber covered electrical wires with receptacle to connect to equipment.

CONDUIT DROP - fixed steel tubing within which electrical wires run to connect to equipment.

## LIGHTING

### HISTORY

Incandescent Lighting	1879
The Fluorescent Lamp	1939
The Halogen Lamp	1959
The Metal Halide Lamp	1964
HP Sodium	1965
Energy Efficient Fluorescent	1973
The Elliptical Reflector	1974
Halogen IR (most efficient PAR lamp)	1989
The T8	1997

### COST

Electricity	75%
Bulb	8%
Labor	17%

**POWER IS THE MOST EXPENSIVE PART OF LIGHTING.**

Example: Replacing F40 Cool White 12 Bulbs in a 50,000 square foot retail facility with T8 bulbs and electronic ballasts produces a payback of 1 year 8 months, a 60% return on investment and a savings of \$54,180 over the life of the

T8 lamps after considering the costs of new lamps, ballasts, labor and electricity. An office building would have the similar savings.

### CHARACTERISTICS OF LIGHTING SOURCES

Type	Life Range	Efficiency (Lumens/Watt)
Incandescent Conventional Tungsten		750-4000 15-25
Incandescent Tungsten Halogen	1000-6000	15-25
Fluorescent	5000-20000	55-80
Fluorescent T8	20000	90-92
HID Mercury	16000-24000	50-60
HID Metal Halide	10000-20000	80-125
HID High Pressure Sodium	16000-24000	70-140

COLOR RENDERING INDEX- a means of measuring a lamps ability to accurately render the colors of perceived objects including both people and objects.

### Sample Comparison

Type of Bulb	CRI
Incandescent Tungsten Halogen	97
Fluorescent F40 Cool White	66
Fluorescent F40 Warm White	89
Fluorescent T8	86
HID Mercury	46-52
HID Metal Halide	65-70
HID High Pressure Sodium	65

INCANDESCENT LIGHTING - light is produced by a wired heated by electricity within a vacuum bulb; generally inefficient; has a relatively short life, approximately 1,000 hours per bulb.

PAR BULB - least efficient industrial incandescent lighting bulb but also the least expensive; lasts approximately 2,000 hours; generally used for exterior lighting.

QUARTZ BULB - most easily aimed and concentrated incandescent bulb; generally used for exterior lighting.

PARABOLIC REFLECTOR - a reflector shaped so that it projects light from a small source in an approximately parallel beam, as in a spotlight.

FLUORESCENT LIGHTING - light is produced by low pressure gasses in long

tubes, excited by electric current; lower operating cost than incandescent lighting.

RAPID START BULB - typical 4 foot long fluorescent office bulb.

SLIMLINE - 8 foot fluorescent bulb; lowest installation cost.

HIGH OUTPUT FLUORESCENT LIGHTING - 8 foot long bulb; best combination of low installation cost and high lighting effectiveness.

POWER GROOVE (VHO) - excellent fluorescent lighting output but superseded by mercury vapor (see high intensity discharge lighting).

T8 - newer energy efficient fluorescent bulb.

INDUSTRIAL FLUORESCENT LIGHTING FIXTURE - lighting fixture with reflector to concentrate light downward.

PAN or STRIP FLUORESCENT LIGHTING FIXTURE – inexpensive “supermarket” fluorescent lighting fixture without reflector.

UPLIGHT SLOTS - provided in high quality fluorescent lighting fixtures to direct some light to the ceiling to reduce contrast and keep lamp cool and clean.

HIGH INTENSITY DISCHARGE (HID) LIGHTING - light is produced by high pressure gasses in bulbs excited by electric current; utilized in high ceiling situations

MERCURY VAPOR - type of high intensity discharge lighting that superseded the fluorescent power groove bulb; the most efficient bulb until high pressure sodium vapor was developed; yellowish light in color.

METAL HALIDE - type of high intensity discharge lighting that is used most often today; provides excellent output per watt; mostly white light in color.

SODIUM VAPOR (HIGH PRESSURE) – today’s most efficient high intensity discharge lighting bulb; can be color corrected; has long life, up to 25,000 hours; generally the best balance of cost and effectiveness; most popular industrial lighting used today.

UNDERFLOOR DUCT - steel flat conduit under slab with easily accessible punch out openings to attach receptacle or telephone connections.

## 12. ELEVATORS

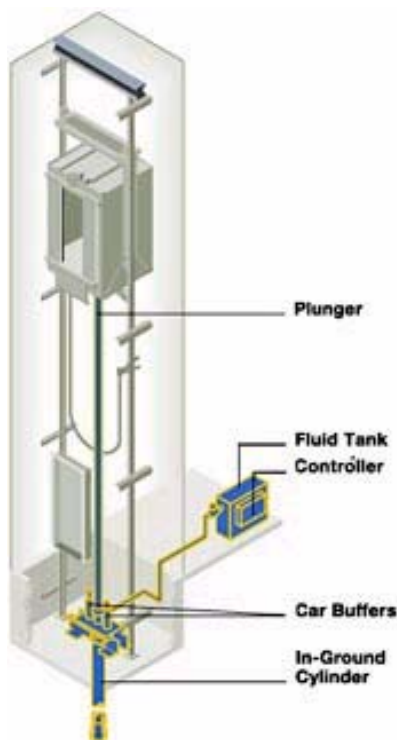
**HYDRAULIC-** an elevator system used in low rise building (up to 7 stories) where a cab is connected to a piston that moves up and down in a cylinder. Movement is controlled by a hydraulic valve. As fluid is pumped into the system, the car rises and as the fluid returns to the reservoir, the car lowers. Least expensive. Slow 100-200 feet per minute. Encourages use of stairs and exercise. Identical to a garage lift.

Usually new models have double bottom cylinder protection against leakage to eliminate the risk of contamination from the fluid.

**GEARED ELECTRONIC TRACTION-** an elevator system designed for mid rise buildings up to 300 feet tall (about 20 stories) and can travel up to 500 feet per minute. In this system, the elevator cab is supported in a hoist way by steel ropes, a sheave and a counterweight. The cab and the counter weight rise along vertical guide rails. The drive sheave is connected to the motor shaft through gears in a gear box.

**GEARLESS ELECTRONIC TRACTION-** an elevator system designed for high rise buildings and used in a large number of the world's tallest buildings. Capacity varies from 2000-5000 pounds, speeds at 800-1200 feet per minute.

Hydraulic Otis Elevator



Roped Hydraulic Otis Elevator

