MAINTENANCE

OF

AIR WASHER SYSTEMS

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by

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DESCRIPTION

As the name implies, an air washer system is a system which removes contaminants from building air conditioning systems by washing it with water. However, since these systems also have the ability to both humidify and cool the air, they are specifically called air washer humidifier systems.

The principal components of an air washer humidifier system, schematically shown in Figure 1 overleaf, consist of a circulating pump, a reservoir with a make-up float valve, drain & overflow, bleed off valve, a humidistat, either spray coils or spray eliminators, either spray nozzles or a corrugated evaporative media, an optional chemical feeder, filter, pre-heat coils, and possibly re-heat coils.

OPERATING MECHANISMS

Air washer systems in commercial and institutional applications are capable of removing particulates which are visible to the naked eye (ie., particles which have a diameter greater than 0.5 microns). As indicated in Figure 2 overleaf, this includes such contaminants in a commercial environment as pollens, lung damaging dust, and bacteria (note that these systems are capable of removing only a portion of tobacco smoke). Particulate matter is removed from the air in two distinct steps (see Figure 3 overleaf). The first step consists of capturing the particle by the water spray. The efficiency of this step is dependent on the relative sizes of the particulate matter and the water droplet (ie., the smaller the diameter of the water droplet, the smaller the size of particle that can be removed). Therefore, atomization of the water spray is required. The second step of particulate removal occurs when the particle is captured by the water droplet. This causes its density to increase and they are separated from the airstream either directly by falling into the basin or by depositing on the eliminator blades.

There are two and sometimes three steps involved with the control of humidity by an air washer system. These steps, illustrated on the psychrometric chart in Figure 4 overleaf, consist of pre-heating the air, adding water to the air, and in some cases re-heating of the air. Pre-heating of the air is required because the mass transfer of water into the air causes the air to be cooled. If a balance can not be struck between pre-heating and humidifying (ie., insufficient pre-heating or too much humidifying), the air must be re-heated in order to control the final air quality within the comfort zone indicated in Figure 4.

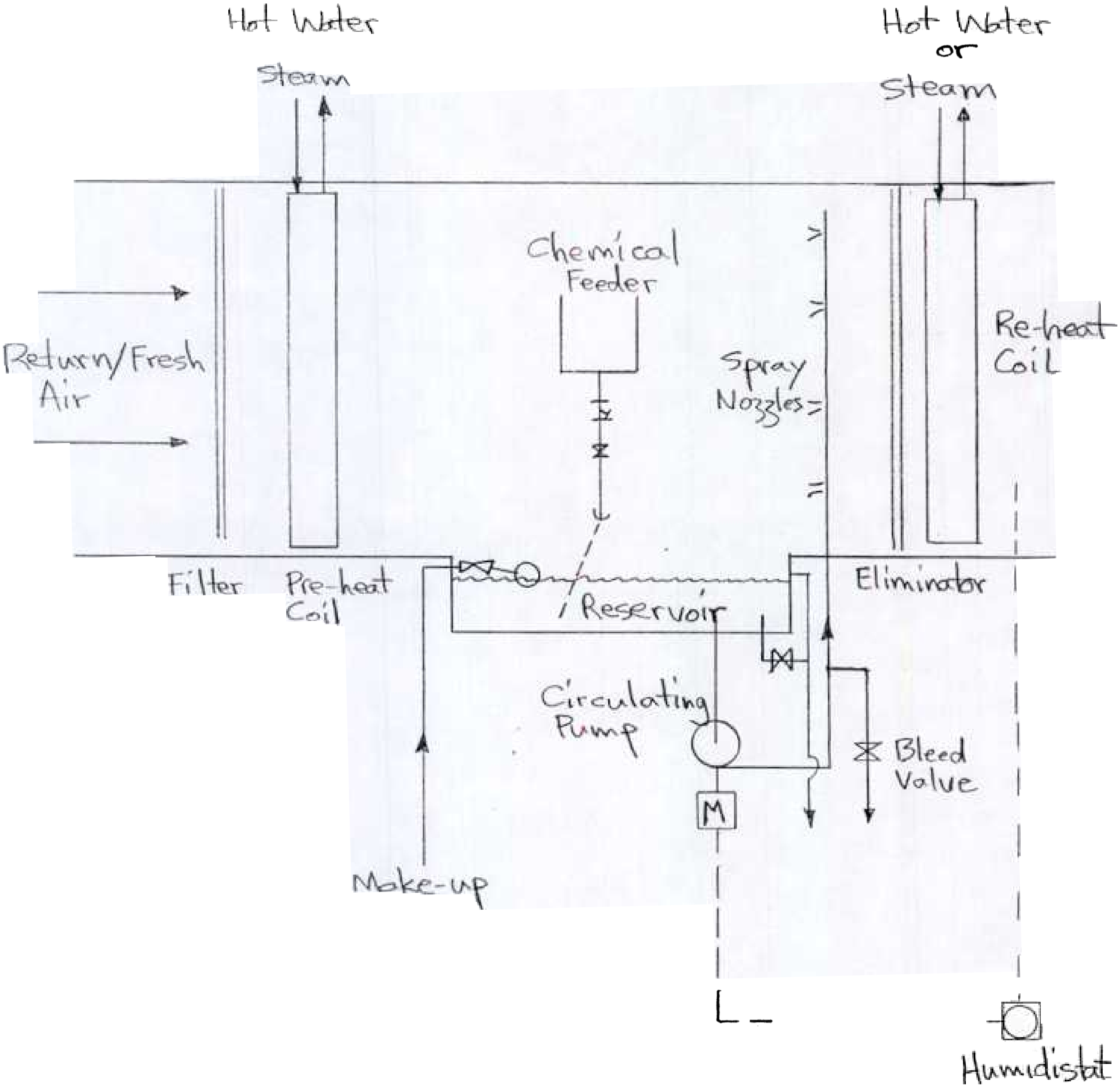
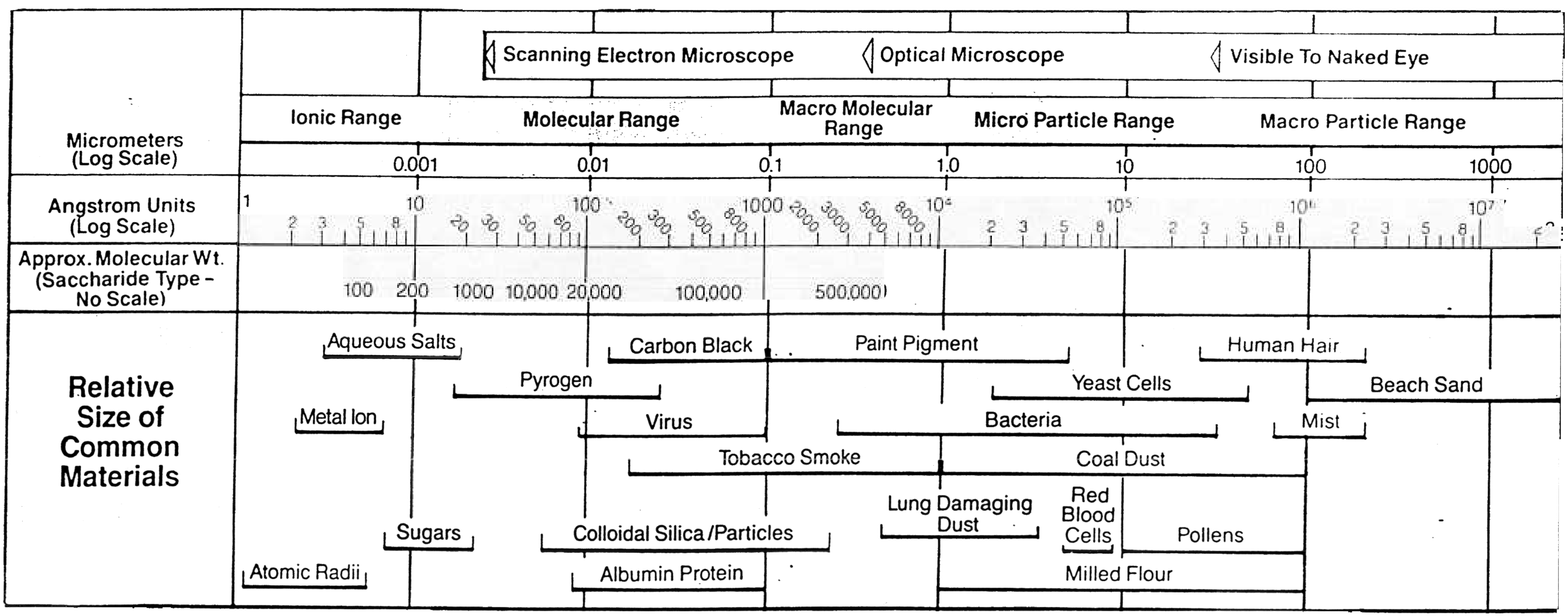


Figure 1: Schematic Drawing of an Air Washer Humidifier System

Figure 2: Range of Particle Sizes



Note: 1 Micron = 4×10^{-5} Inches (0.00004 Inches)
1 Angstrom Unit = 10^{-10} Meters = 10^{-4} Micrometers (Microns)

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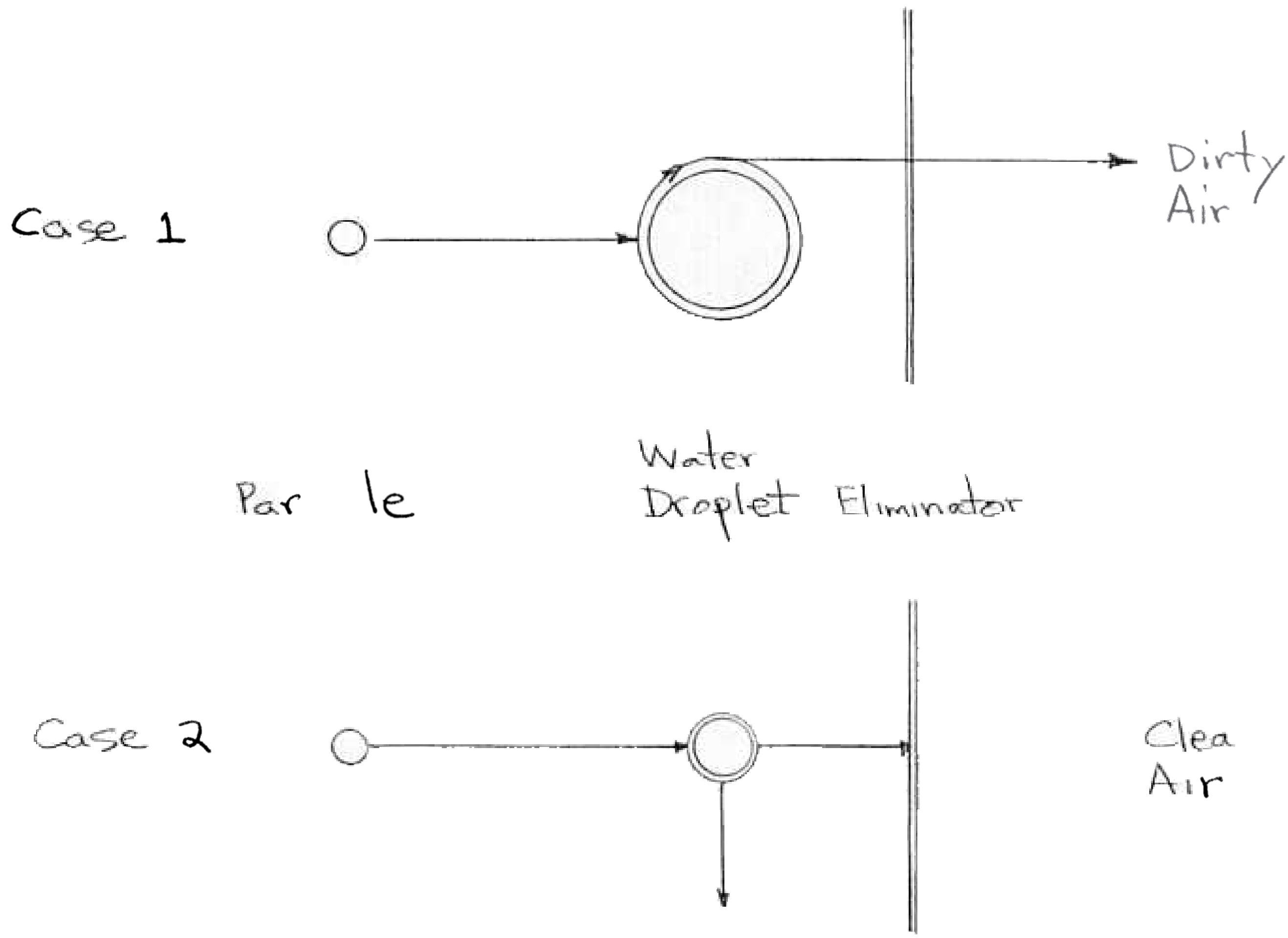


F gure 3 Mechanism of Part culate Removal

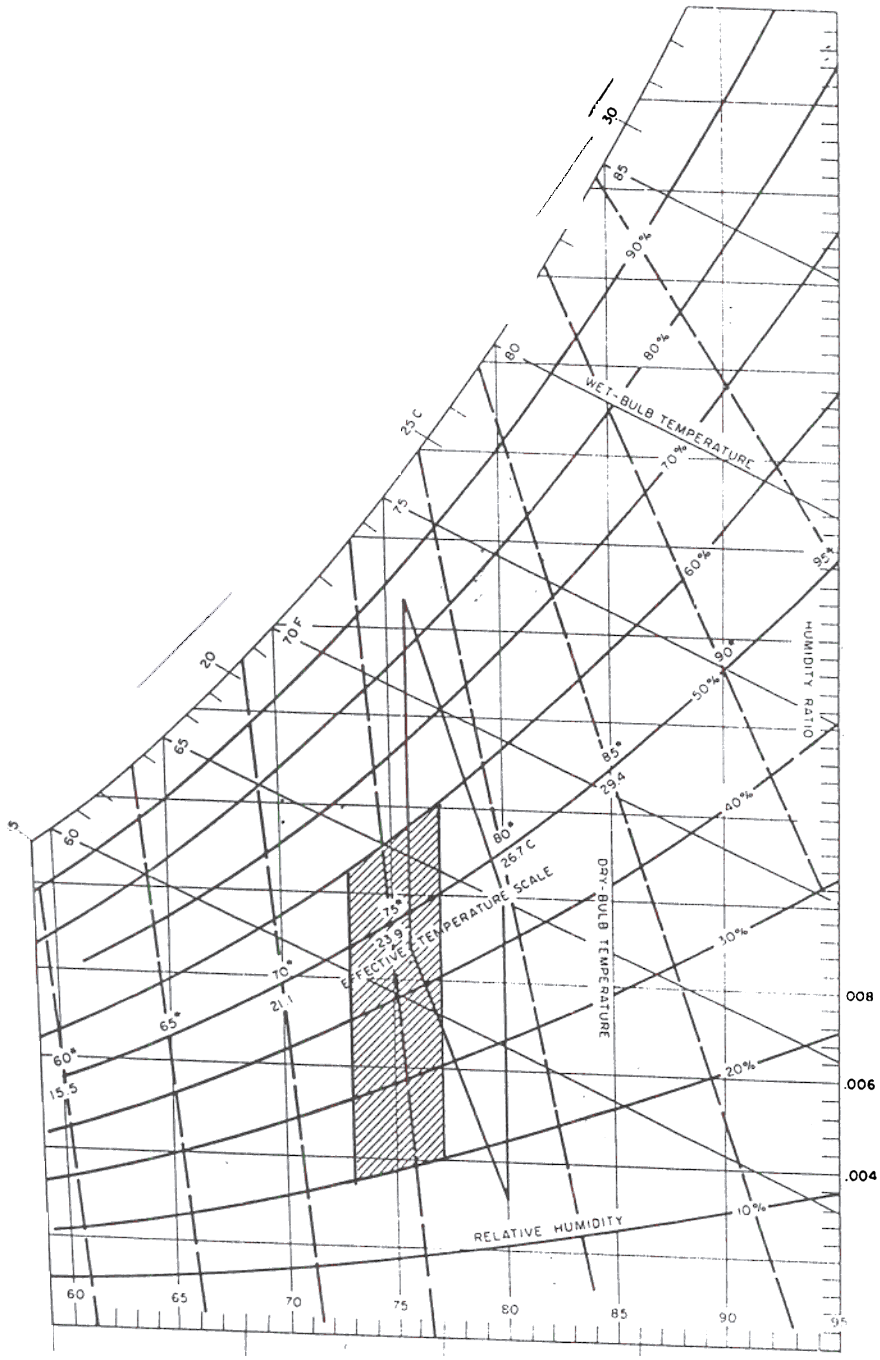


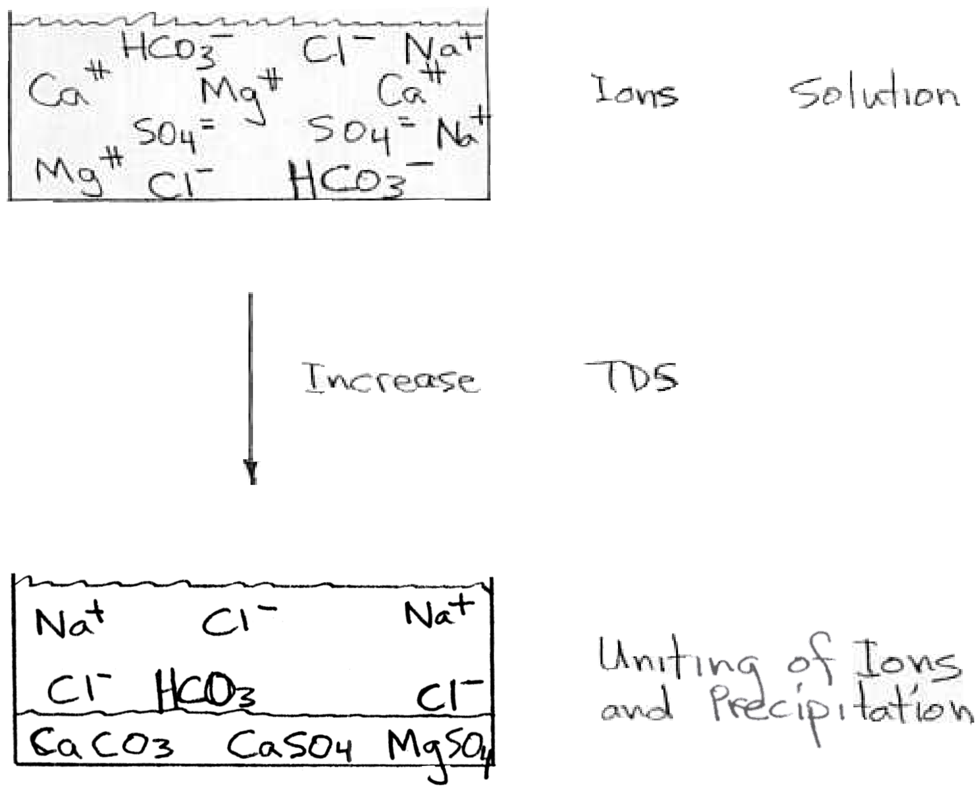
Figure 4: Psychrometric Chart

OPERATING PROBLEMS

The most common operating problems associated with air washer systems consist of scale and bacteria formation.

Scale is formed either in the reservoir or on the eliminator blades when the TDS of the water in the reservoir is allowed to increase to a point where the solubility of a particular compound (see Figure 5 overleaf) is surpassed. If scale deposits are allowed to accumulate on the spray nozzles and eliminator blades, the spray nozzles will plug, thus causing inefficient particulate removal and poor humidification because of irregular spray patterns, and the building air handling system will pass on the deposits into the work place.

Similarly, bacteria is formed either in the reservoir or on the eliminator blades when the TDS of the water in the reservoir is allowed to increase to a point where there is a sufficient nutrient level to support its growth. This contamination is also passed on into the work place.



Order of Precipitation

Cal ium	Phosphate
Magnesium	Carbonate
	Sulfate

Figure 5: Scale Formation

MAINTENANCE

The maintenance of an air washer system consists of both physical cleaning and chemical control. One of these activities can not be replaced by the other.

The spray nozzles, eliminator blades, and reservoir must be manually cleaned by scrubbing & flushing activities at a frequency which can only be determined by visual inspection of the unit.

Chemical control consists of a combination of TDS control and the additions of a dispersant such as sodium hexmeta phosphate & a biocide such as sodium hypochlorite (ie., bleach). The TDS of the water in the reservoir should be controlled by adjustment of the continuous bleed-off valve such that it is approximately twice that of the make-up water. Sodium hexameta phosphate is added to the reservoir either manually or continuously via a drip feeder such that a phosphate concentration of approximately 5-10 ppm is maintained. Note that if the TDS is allowed to go out of control, scale will develop in spite of the phosphate addition (ie., TDS control & scale control go hand-in-hand). The formation of bacteria in the system is prevented by control testing and biocide addition. A bacteria test kit is available from Sam for control testing in the field. If the water in the basin has a positive bacteria count, a biocide must be added batch-wise in the form of shock dosing. In most cases, liquid sodium hypochlorite is quite adequate, however, the fan should be shut down during this operation in order to avoid the spread of chlorine odor in the building. As with scale control, bacteria control and TDS control go hand-in-hand because of the higher nutrient level in waters with high TDS levels.

CONTROL TESTS

In order to prevent deposit carry-over, scale formation, and bacteria formation, a record of the following control tests (see attached example) should be maintained:

1. Record the appearance of the spray nozzles, eliminator blades, and bottom of the reservoir at a frequency of once per week;

2. Record any physical cleaning activities;

3. Determine and record the TDS & phosphate concentrations in the water in the reservoir at a frequency of at least once per week;

3. Record the results of the bacteria testing of the water in the reservoir at a frequency of at least once per month;

4 Record the additions of bleach at a frequency of 1-2 times per month.

RECORD OF CONTROL TESTS FOR AIR WASHER SYSTEMS

Building:

System:

Month:

Date	TDS	Phosphate	Bacteria	Chemicals Added (phosphate)	(bleach)	Comments
1						
2						
3						
4						
5						
6						
7						
8						
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Control Limits:

TDS : maximum of twice that of domestic water
phosphate : 5-10 ppm PO4
bacteria count: nil