WATER TREATMENT

FOR

HUMIDIFIER SYSTEMS

Presented at

Alberta Public Works, Supply & Services
Property Management

Water Treatment Co-ordinators' Meeting #28
Northern Alberta Jubilee Auditorium
Edmonton, Alberta
October 28th 1998

by

G.F. Yuzwa, P.Eng.

H2O ENGINEERING LTD.
539 Edgemont Bay N.W.
Calgary, Alberta
T3A 2K7

INTRODUCTION

Water is added to building air systems in order to prevent human nostrils, throats & eyes from becoming dry, to prevent furniture & artefacts from drying out, and in a computer environment to prevent static electricity. The systems that are most commonly used for this purpose include electric steam humidifier systems, air washer humidifier systems, and steam humidifier boiler systems. The water treatment practices that are utilised to prevent excessive scale & corrosion in these systems are outlined herein.

ELECTRIC STEAM HUMIDIFIER SYSTEMS

The basic components of an electric steam humidifier system consist of a disposable canister with integral electrodes, and an electrical power source. Water is boiled in the canister and the steam that is produced is directed to the air handling system, leaving the minerals that were dissolved in the water as deposits in the canister. As the mineral deposits build up in the canister, steam production is reduced and ultimately stops, at which time the canister is replaced with a fresh one.

Water treatment is **not** required for these systems; however, proper operation of the automatic flushing action of the water in the canister will extend their useful operating time. Softening of the feedwater to these systems is **not** recommended because the corrosive property of hot soft water would result in excessive corrosion of the electrodes.

AIR WASHER HUMIDIFIER SYSTEMS

The basic components of an air washer humidifier system consist of a media (i.e., pre-formed paper or plastic modules, or heating/cooling coils), a circulating pump, and a water supply. As their name implies, these systems not only humidify the air, they also wash dirt & debris out of the air. There are two different types of air washer humidifier systems, namely the once through type and the re-circulating type. In both types of systems, the media/coil is saturated with water, the water is transferred from the media/coil into the air stream by evaporation, and the minerals that were dissolved in the water are deposited onto the media/coil. Softening of the feedwater to these systems is **not** recommended because the soft scale deposit that would be produced would be carried away from the media and into the building by the air handling system. The use of hard water produces a hard scale deposit which tends to adhere locally onto the media.

In the once through type of air washer humidifier system, water is directed to the top of the media and allowed to flow downward over the media, flushing most of the mineral deposits from the media to drain. Water treatment is **not** required for these systems; however, control of the water flow will improve their operation. That is, during operation, the water flow to the top of the media should be just enough to saturate the media, thus promoting mineral deposition **only** onto the media. Excessive water flow must be avoided as it will result in water “throw” and mineral deposition onto other parts of the system such as fan blades.

When an excessive amount of mineral deposits have built up on the media, the fan should be shut-off, and a full water flow should be directed to the top of the media until the mineral deposits are washed off the media to drain.

In the re-circulating type of air washer humidifier system, water is pumped from a basin, and onto the media/coil via spray nozzles. Excess water trickles down the media/coil and back into the basin. The water that is lost from the system through evaporation and bleed-off is replaced with fresh water addition to the basin via a float valve. Water treatment is required for these systems because of the increased mineral content in the re-cycled water. A typical water treatment program consists of chemical addition and monitoring. Chemical treatment involves the addition of a poly phosphate (i.e., generic hexameta phosphate or proprietary poly phosphate) for scale control and a non-oxidising biocide (e.g., myacide) for bacteria control. The use of an oxidising biocide such as sodium hypochlorite must be avoided for these systems because this type of chemical decomposes the glue that holds the media together. Water samples of the basin water must be tested 2-3 times per week for routine tests (i.e., TDS & phosphate) and once per month for bacteria concentration in order to maintain the control limits indicated in Table 1 below.

Table 1: Control Limits for Re-Circulating Air Washer Humidifier System

Parameter	Control Limits
Basin Water	
TDS, ppm	Maximum of 2-3 times TDS of make-up water
Poly Phosphate, ppm PO_4	10-20
Bacteria, cfu/ml	10^3 maximum

STEAM HUMIDIFIER BOILER SYSTEMS

The basic component of a steam humidifier boiler system consists of a steam boiler. There are two different types of steam humidifier systems, namely, the combined heating/humidifier steam boiler system, which **does** have a condensate return system, and the dedicated steam humidifier boiler, which normally does **not** have a condensate return system. In both types of systems, the steam that is produced in the boiler is directed to the air handling system. The feedwater for these systems must be softened in order to prevent scale formation in the boiler.

Water treatment is required for these systems in order to prevent scale formation & corrosion of the boiler, and corrosion of the condensate return system. A typical water treatment program consists of chemical addition and monitoring. Chemical treatment involves the addition of phosphate (i.e., generic hexameta phosphate or tri-sodium phosphate) & caustic for scale control, and sodium sulphite & neutralising amine for corrosion control. Boiler water, feedwater & condensate samples must be tested daily for large multi-boiler systems and 2-3 times per week for smaller systems.

Steam humidifier boiler systems that are used for special applications (i.e., artefact preservation, computer environment, etc.) must **not** incorporate a neutralising amine addition since this chemical will deposit on the sensitive material. Therefore, the bicarbonate alkalinity must be removed from the feedwater for these systems in order to avoid the corrosive effects of carbon dioxide that would otherwise occur.

Since the combined heating/humidifier steam boiler systems do have a condensate return system, amine addition is required for these systems in order to neutralise the carbon dioxide that is produced when the feedwater bicarbonate alkalinity is decomposed in the boiler. The 8 hour exposure limit for morpholine in air is 20 ppm as stated in the Alberta Occupational Health and Safety Act, Chemical Hazards Regulation. Therefore, excessive amine addition must be avoided. Air samples of buildings in which morpholine is used have indicated less than detectable amounts of morpholine; however, as a precautionary measure, the condensate pH control limits, which are directly related to the morpholine concentration, are reduced for the combined heating/humidifier steam boiler systems during the humidification season as indicated in Table 2 overleaf.

Table 2: Control Limits for Combined Heating/Humidifier Steam Boiler System

Parameter	Control Limits
Boiler Water	
PH	10.5-11.5
TDS (neutralised), ppm	1500-3000
Sulphite, ppm SO_3	30-60
Total alkalinity, ppm $CaCO_3$	700 maximum
Hydroxide alkalinity, ppm $CaCO_3$	150-300
Phosphate, ppm PO_4	40-80
Feedwater	
Hardness, ppm $CaCO_3$	2 maximum
Condensate	
pH (during humidification season)	8.0-8.5
pH (when humidification is **not** in use)	8.5-9.5
TDS, ppm	50 maximum

Since the dedicated steam humidifier boiler systems normally do **not** have a condensate return system, amine addition is **not** required for these systems. However, for these types of systems that do have a condensate return system, amine addition is required, and as a precautionary measure, the condensate pH control limits, which are directly related to the morpholine concentration, are reduced as indicated in Table 3 below.

Table 3: Control Limits for Dedicated Steam Humidifier Boiler System

Parameter	Control Limits
Boiler Water	
PH	10.5-11.5
TDS (neutralised), ppm	1500-3000
Sulphite, ppm SO_3	30-60
Total alkalinity, ppm $CaCO_3$	700 maximum
Hydroxide alkalinity, ppm $CaCO_3$	150-300
Phosphate, ppm PO_4	40-80
Feedwater	
Hardness, ppm $CaCO_3$	2 maximum
Condensate	
PH	8.0-8.5
TDS, ppm	50 maximum