Water Cooling Tower Prevents Spout Bursts and Saves Water at Star

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In conventional spray type Soda Recovery units the smelt spout is generally water cooled. In order to save the material of construction cold water at room temp. is forced circulated through the spout and put to drain through overflow vessels at the operating floor (Fig. 1). Putting overflow vessels at operating floor ensures a visual check on amount of flow and it also serves as a guide to switch over to alternative water sources in case of power failure or otherwise.

"Star" faced a peculiar situation with this system. The raw water had a temporary hardness as high as 225 ppm. (Table I). It was noticed that after a week or 10 days operation the cooling spaces in the spout used to get filled up with carbonate scales and due to insufficient cooling the spout used to burst resulting in the leakage of water to the furnace and causing breakdowns. Smelt out without water often damaged the whole spout. Moreover, descaling and repair required high maintenance costs.

An engineering study was undertaken to solve out this problem. Clacium Carbonate was the chief ingredient of the scale formed. Calcium Carbonate is more insoluble than calcium silicate and calcium sulphate and this fact accounted for its more frequent appearance in the form of scale. Though the factors which affect scale formations are temp., rate of heat transfer, the Calcium Sulphate, Magnesium, Silica, Alkalinity, dissolved solids and pH of the water, little could have been done to improve upon the wholewater supply.

An engineering study indicated that the most economical and logical solution would be to instal a water cooling tower which will save the spout on one hand and reduce the net consumption of raw water on the other.

Tower Description:

The water cooling tower is a 'HEENAN' cooling tower designed for the following duty:—

Water rate—100 gpm
Temp. of water coming to tower—45-48°C
Temp. of water coming out of tower—35-38°C
Ambient wet bulb temp. 27°C

It consists of a steel casing in which the cooling surfaces are arranged and to one side of which an axial flow fan is fixed for putting in the forced draught (Fig. 2) water distribution nozzles are fixed above the cooling surfaces to allow distribution of hot water evenly over them. The base of the framework as a tank from which the cooling water is drawn for cooling. A float valve assembly is arranged in the tank by means of which water lost by evaporation is continuously made up. Moisture eliminators are fitted on the top of the tower which allows the volume of forced draught air to pass through but intercepts the drops of moisture.

Tower Operation :

The tower was commissioned on 13-5-65 and since then it is working well. Fig. 3 explains the new system. Since the time the tower has been put in we did not had any spout leakage except that an isolated case in June, when the spout had developed a minor crack on one of the previously repaired welding joints. Table II shows the spout changing schedule from

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Aug. '64. Table III shows the different temps. obtained at the inlet and outlet of tower.

Conclusion :

Installation of the cooling tower to supply recycled water to spout has virtually eliminated the spout bursts and has resulted in reduction of fresh water consumption. The system is operated successfully with no problem of corrosion or microbiological growth. Intensive efforts are at hand to reduce the process water requirement and to reduce such undesired shutdowns in the recovery furnace.

Ref.: (i) Detz Handbook of Industrial Water Conditioning.
(ii) Process Heat Transfer by D.Q. Kern.

TABLE I

Raw Water Analysis

Test Method for	Sample
Total Hardness	224 ppm
Alk. to phenolphttiation	Nil
Alk. to methyl orange	250 ppm
Temporary Hardness	224 ppm
Permanent Hardness	nil
Magnesium	97 ppm
Sulphate	12 ppm
Chloride	6 ppm
Nitrates	Less than 6 ppm
Silica	25 ppm
Iron	Less than 0.05 ppm
pH at 22°C	7.5
Dissolved solids.	300 ppm.

TABLE II

Spout changing dates	*Dates on which spout changed*
Aug. 64	23rd
Sept.	nil
Oct.	11th
Nov.	nil
Dec.	11th
Jan. 65	nil
Feb.	nil
March	10th, 17th
April	18th
May	Spout cooling water system commissioned.
June	11th minor crack in welding joint.
July	nil
Aug.	nil
Sept.	nil
Oct.	nil

TABLE III

	Inlet temp. to Tower °C	*Outlet from Tower*	*Dry Bulb*	*Wet Bulb*
23.6.65	31°C	31°C	42°C	30°C
	35°C	32°C	40°C	30°C