control and reheat control. The selection of units should be made with regard to noise level when related to the noise level of the spaces. The inductive capacity of the unit increases with the jet velocity but too high jet velocities result in a high noise level.

Induction Units—High pressure type

A recent development of the induction unit as previously outlined is the high pressure type of unit. This unit employs nozzles which produce a high velocity jet quietly. The term, high pressure type of unit, is to some extent inaccurate since the pressure at the nozzles, while several times that of the low pressure unit, is still less than the total resistance pressure of a conventional central system. The high velocity jet of primary air induces a flow of secondary room air through coils located in the secondary air stream. The coil in the secondary air stream is supplied with chilled water in summer and hot water in winter and thus handles a large portion of the room sensible heat gain in summer and of the room sensible heat loss in winter. The primary air is supplied at a sufficiently low dew-point to take care of room latent heat gain in summer. In winter, it is supplied at a sufficiently high dew-point to take care of room latent heat losses. Control of temperature is obtained by throttling the water quantity supplied to the secondary coils. The quantity of primary air is greatly reduced due to the fact that a portion of the room sensible heat load is carried by the secondary air stream coil. Since the primary quantity is small, very high velocities can be carried in the supply ducts without requiring fan power in excess of that required for a conventional system. This means that the supply ducts or pipes can be very small and can be run in chases, or furred in at columns with the water pipes. The primary air is treated in the usual manner to provide air at the required dew-point and either a surface or spray dehumidifier or a dehydrator may be used. The primary air quantity is sufficient for ventilation purposes, and frequently consists entirely of outdoor air. The water piping for the units can be so arranged and valved that hot water can be supplied to one zone that may require heating while cold water may be supplied to a zone that requires cooling.

This system is usually limited in application to hotels, apartments, office buildings and other multi-room installations having a large perimeter with relation to the floor area. The units are usually installed beneath the windows, replacing direct radiation or convectors. Where the spaces to be conditioned extend a large distance from the outer wall into the interior of the building, a separate system or zone for the conditioning of the interior portions may be required.

Evaporative Cooling

In climates where on design maximum days, the outdoor wet-bulb depression is relatively high it may be possible to dispense with refrigeration or other cooling sources by use of the evaporative cooling effect. A well designed air washer using recirculating sprays will reduce the entering dry-bulb temperature to within a degree or two of the entering wet-bulb condition. Thus, it may be possible that with air entering at 100 F dry-bulb and 60F wet-bulb temperature a leaving condition of

62 F dry-bulb, nearly saturated can be obtained. Under some conditions of latent and sensible heat load the results may be entirely satisfactory.

Under those conditions when the outdoor wet-bulb temperature is not quite low enough to permit the use of straight evaporative cooling it is possible to use precooling coils with refrigeration, well water or a cooling tower as the basic source of cooling to lower the wet-bulb temperature (by sensible heat removal) of the air before it enters the air washer. Where internal heat loads are high, this may be more economical than using return air. Under other conditions where the required supply air dew-point is too low to permit straight evaporative cooling and the sensible heat load not too great, intentional partial saturation may be employed. That is, the low dew-point of the outdoor air is utilized by permitting some of it to pass through the humidifying sprays untreated or pass around the humidifier. All of these remarks with regard to evaporative cooling are based, as indicated, on the assumption that the supply air will consist entirely of outside air. Provision should be made for the return of air from the conditioned spaces for control purposes as well as for winter use in all cases.

Precooling

Where sufficiently cold water from wells or streams is available a saving in the refrigeration cycle may be obtained by the use of precooling. Cooling coils are placed ahead of the dehumidifier or conditioner and the cold water from a well or stream circulated through the coils. The resultant cooling of the air decreases the load to be carried by the dehumidifier and refrigeration plant. In normal practice the water after passing through the precooling coils is delivered to the refrigeration plant for condensing purposes. The economic advantages of this scheme are apparent and it is frequently used.

Sensible Cooling with Dry Cooling Coils

Under certain atmospheric conditions where a large wet-bulb depression exists and the dew-point of the outdoor air is sufficiently low at all times, proper inside conditions may be obtained by removing sensible heat only from the outdoor air and supplying it to the spaces. Under this condition of a high wet-bulb depression a cooling coil may be located in the air stream and this coil supplied with water from a cooling tower of one type or another. When humidity control is desired sprays to saturate or partially saturate the air may be used after the dry cooling coil. Saturation or partial saturation after the dry air cooler will further reduce the dry-bulb temperature of the supply air and reduce the supply air quantity required. This system has very definite application in hot dry climates and in general is most economical.

Run-Around System

An interesting method of control is found in the use of combined reheating and precooling usually termed the *run-around system*. Coils are placed in the air stream before and after the conditioner and water or brine is circulated around the conditioner from one coil to the other. The water passing through the reheating coil is cooled by the air leaving the dehumidifier and the air is heated by the water. The cooled water is then