WALCHEM

IWAKI America Inc.

SAMPLE LOOP ACCESSORY INSTALLATION INSTRUCTIONS

1.0 OPERATION

The sample loop may consist of all or any combination of the accessories as well as the flow through sensor and/or the pH electrode. There are some general guidelines in the installation of the sample loop which will help eliminate most of the common problems encountered. One important guideline to keep in mind is that the entire sample loop should be kept as short as possible. Following are functional descriptions of the accessories and how they can fit together into the sample loop system:

A cooling coil is recommended whenever an electroless copper or nickel sample is being taken from the bath for evaluation. Cooling will help reduce the likelihood of plate-out in the sample loop and any of the accompanying accessories. Cooling is also required if the liquid temperature is high, and a low-temperature recirculation pump is used in place of the bath's filter pump. If a pH electrode requires a lower temperature than that of the bath it must be installed after the cooling coil. The cooling coil must always be the first accessory in the sample loop. This helps ensure that all the media is cool before entering the sensor, pH adapter assembly, pump, etc.

The cooling coil should be mounted in a vertical orientation using the two mounting hangers provided. The sample inlet/outlet can be either up or down. There are two ½" NPT holes to connect the rinse or cooling water flow. This can be straight from the tap and then run to the rinse tank (preferred) or it could be separate recirculation pump just for the cooling /rinse water. The cooling water should be below 70°F. The flow rate of the cooling water should be kept to at least ½ GPM (1¾ L/min), but ¾ GPM (2¾ L/min) is preferred). The cooling water should flow in from the bottom of the cooling coil and out the top.

A pH adapter assembly is required when an in-line pH electrode is to be used in the sample loop. It allows a pH electrode to be mounted in an orientation which will keep the electrode immersed at all times. The pH adapter assembly is supplied with two wall mounting hangers and should be mounted horizontally such that the electrode is inserted vertically from the top. The "U" trap design will ensure that liquid is always in contact with the electrode. Note: If a low temperature recirculation pump is used and runs dry, it may empty the trap to the extent that the electrode will no longer be immersed.

If a sample pump is required, it must be placed at the end of the sample loop - at least downstream of the sensor. The pump should run in the range of 400-500 ml/min (approx. 0.11-0.13 GPM) once installed in the sample loop. If it runs faster than this, cooling will be inadequate. (There is no upper limit to the flow rate if cooling is not required.) Lag time, however, is an important consideration when the pump is throttled back. Please see Application Notes for further details.

2.0 INSTALLATION

Following is a list of flow through sensor/sample loop guidelines which should be followed:

- Mount the sensor on a vibration-free, vertical surface so that the sensor tubing inlet connection is at the bottom and the outlet is at the top. The vertical orientation will prevent air bubbles from being trapped in the sensor.

IMPORTANT NOTE: Take care to support the flexible plastic tubing that you attach to the inlet and outlet connectors so there is no pressure pushing or pulling the connectors from side-to-side. Failure to follow these instructions will result in internal leakage that may damage or destroy the sensor.

- Install a shut-off valve at the beginning of the sample loop so that the system may be shut off quickly if necessary.

- If a sample pump is to be used, it must be installed last, after the flow through sensor and the cooling coil, if applicable. A flow control valve may be required on the inlet side of the pump to adjust flow rate to the desired setting.

- If a high temperature recirculation pump is to supply the sample flow, adjust flow rate through the sample loop between 400-500 ml/min (approx. 0.11-0.13 GPM). This flow rate will help ensure adequate cooling of the solution while maintaining a reasonable lag time in longer runs of tubing. If this is not possible or is undesirable, see Application Notes below.

Other installation guidelines which may be helpful in the overall system:

- Keep tubing distances to the sensor inlet as short as possible to avoid hydraulic lag time. Maximum recommended length of tubing from solution to sensor is 25 feet. If this is not possible, see Application Notes Section.
- The solution inlet should draw sample from an area of good solution movement to respond quickly to chemical additions. However, the solution inlet should not draw too near to where the chemistry is added to avoid artificial ‘spikes’ in concentration.
- The solution discharge should be open to atmospheric pressure to ensure proper flow.
- If a pH electrode and adapter assembly are to be used, the pH adapter assembly must be mounted horizontally so that the electrode can be inserted from the top vertically.
- The cooling coil should be mounted vertically using the pipe hangers provided. The orientation is not critical.

Application Notes

If the distance from the solution to the sensor is further than the recommended length of 25 feet, the maximum lag time must be calculated from the desired control band to determine a pump flow rate based on a given distance of standard, uniform tubing. The maximum lag time is the maximum allowable time for the solution to continuously get to the sensor to achieve the desired control band.

To calculate maximum lag time:

$$\text{Max. Lag time} = \frac{\text{Desired Control Band*}}{4 \times \text{Depletion Rate}}$$

where Control band = Maximum deviation of concentration

Depletion rate = Rate at which the bath will deplete per unit of time

*The deadband should be adjusted so that it is 1/4 the desired control band.

- For Example: The set point is 4.00 g/L.
- If the desired control band is 0.20 g/L (± 0.10 g/L or 2.5%) and the bath is depleting at a rate of 1.25 g/L every 15 minutes (0.08333 g/L every minute),then

$$\text{Max. Lag time} = \frac{0.20 \text{ g/L}}{4 \times (0.08333 \text{ g/L /min})} = 0.60 \text{ minutes}$$

So, 0.60 minutes is the maximum time it should take for the solution to reach the sensor.

To calculate pump flow rate:

$$\text{Minimum Pump Flow Rate} = \frac{\text{Volume of System*}}{\text{Maximum Lag time}}$$

Where Volume of system = B $(\text{Tubing ID}/2)^2$ x Length of tubing

Maximum lag time = Previously calculated time to get solution to sensor.*
Volume is based on length from solution to sensor, *not* the return.

For Example: If the system parameters are: Tubing is 3/8" O.D. 1/4" I.D.
Length is 30 feet (360 inches)

then the volume of the system = B $(0.25\text{in}/2)^2$ x (360 in) = 17.7 in3

Note:	1 U.S. Gallon	=	231 U.S cubic inches
	1 Liter	=	61.03 U.S. cubic inches

Volume of the system = 17.7 in^3 / (231 in^3 /gallon) = 0.0765 gallons

Maximum lag time = 0.60 minutes (previously calculated)

So, the minimum pump flow rate
= 0.0765 gallons / 0.60 minutes = 0.127 gal/min (483 mL/min)

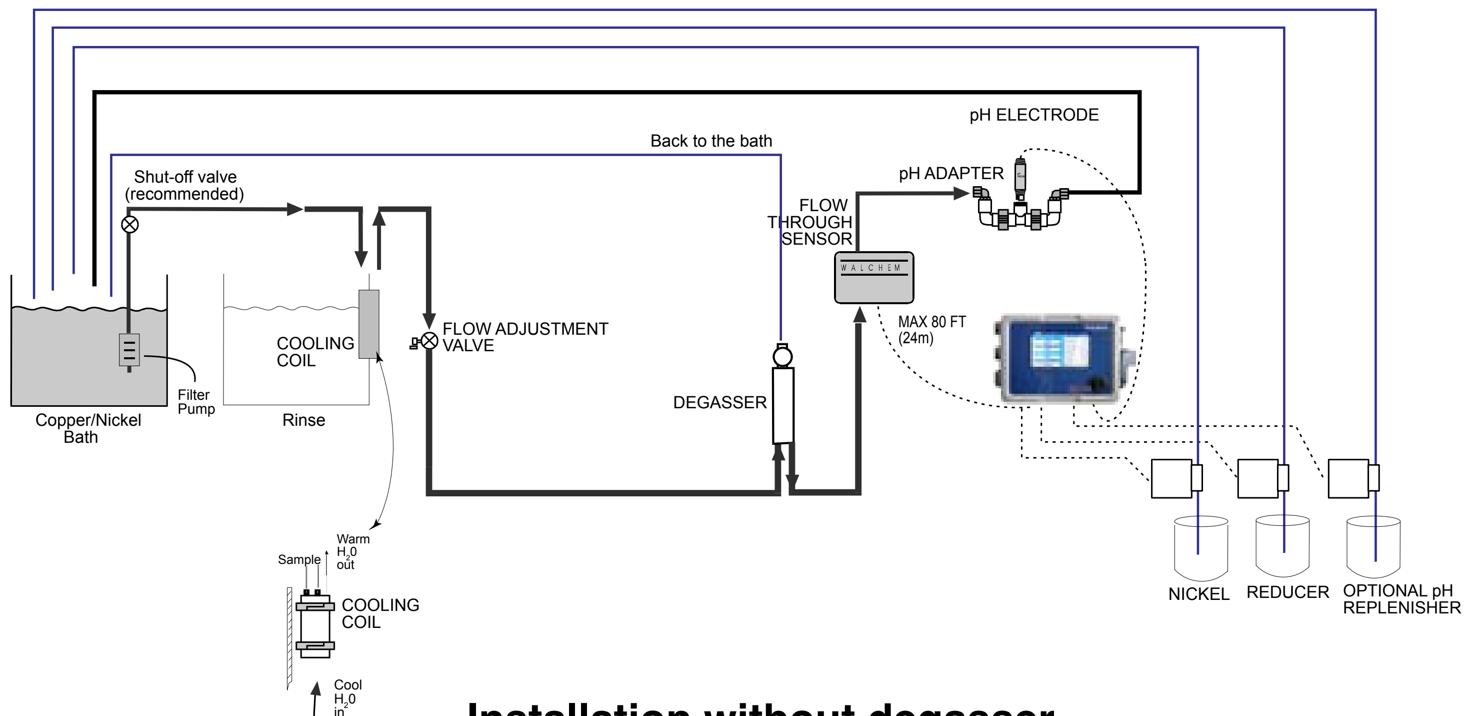
Caution: The calculated pump flow rate is the minimum required to obtain the desired control band, however, if the flow rate increases over the recommended rate of 500 mL/min (approx. 0.13 gal/min) the rate of cooling will decrease. This may be compensated for by re-evaluating the system criteria: length / desired control band or to double up on the cooling plate/coil.

Consult factory with any further installation questions.

3.0 MAINTENANCE

The sample loop should be examined periodically for signs of plate-out or other coatings in the accessories or tubing. Chemical cleaning is preferred over mechanical cleaning methods. Plate-out should be removed using nitric acid, or a persulfate or peroxide/sulfuric etch.

Installation including degasser



Installation without degasser