EEL4935/6936 – Power Plant Engineering

Homework #7: Plant Instrumentation & Control Systems

Due: 04/13/09

#1. What are at least 4 physical parameters that are needed to be monitored in a power plant to provide adequate information for process control?

_____
_____
_____
_____

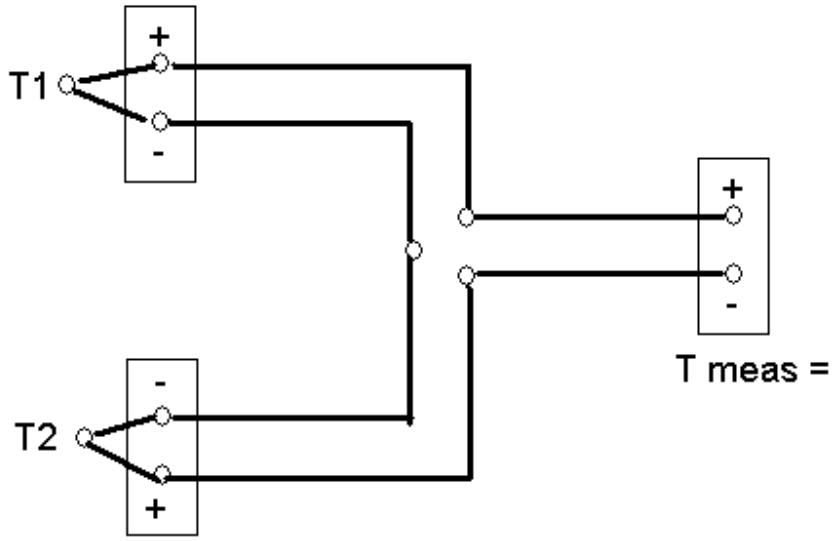
#2. You need to replace a thermocouple in a plant process and no information is known on the device. However, when locating the device you see that the conductor color on the positive connection is yellow and the conductor color on the negative connection is red. Knowing that the plant was built to US standards, what is the type thermocouple you need to use to replace the existing device?

A. Type J
B. Type K
C. Type T
D. Type E

#3. An pressure of 30 psia approximately equals...
A. 30.0 psig.
B. 15.3 psig.
C. 14.7 psig.
D. 0.0 psig.

#4. With the thermocouple connection shown below, what is the measured temperature (assume cold junction temperature compensation at the measuring end)?

A. T meas = T1 + T2
B. T meas = T1 – T2
C. T meas = T2 – T1
D. T meas = –T1 – T2

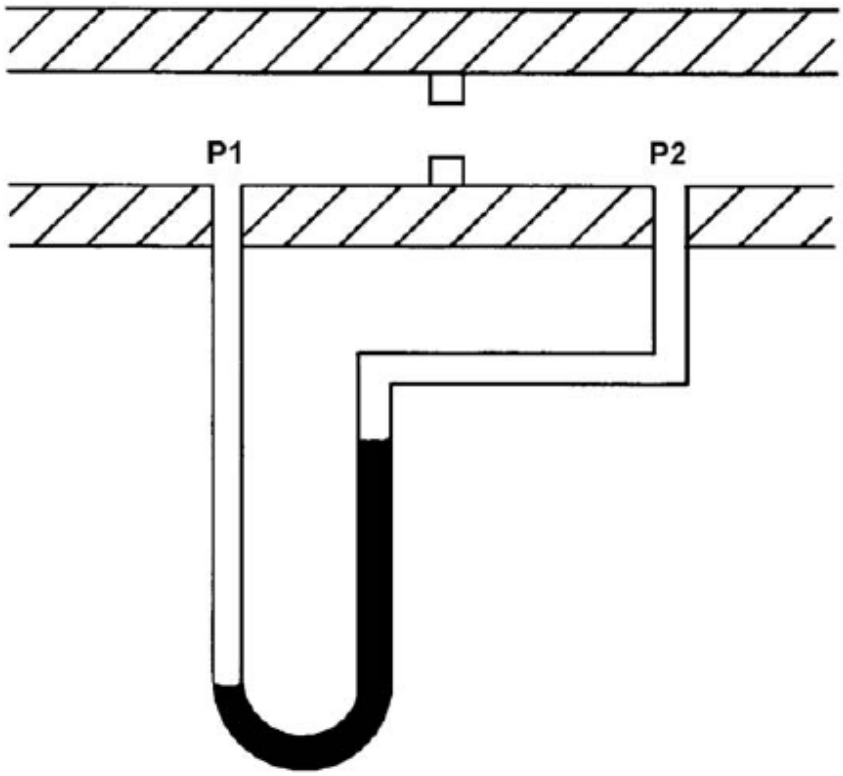


#5. The typical reference resistance of a Copper RTD is?

A. 10 OHM
B. 25 OHM
C. 100 OHM
D. 200 OHM

#6. Refer to the drawing of a differential pressure manometer (see figure below).
A differential pressure manometer is installed across an orifice in a ventilation duct. With the ventilation conditions as shown, the pressure at P1 is _____ than P2, and airflow is from _____.

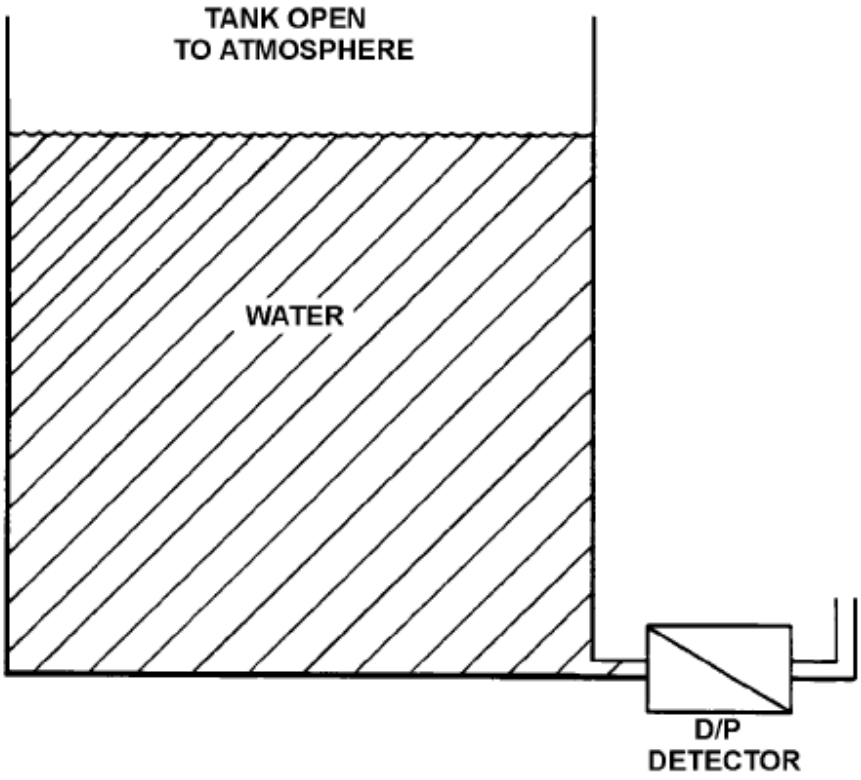
A. greater; left to right
B. greater; right to left
C. less; left to right
D. less; right to left



DIFFERENTIAL PRESSURE MANOMETER

#7. A water storage tank is vented to atmosphere. The tank is located at sea level and contains 100,000 gallons of 80 ^{o}F water (specific gravity of 1.0). A pressure gauge at the bottom of the tank reads 5.6 psig. What is the approximate water level in the tank?

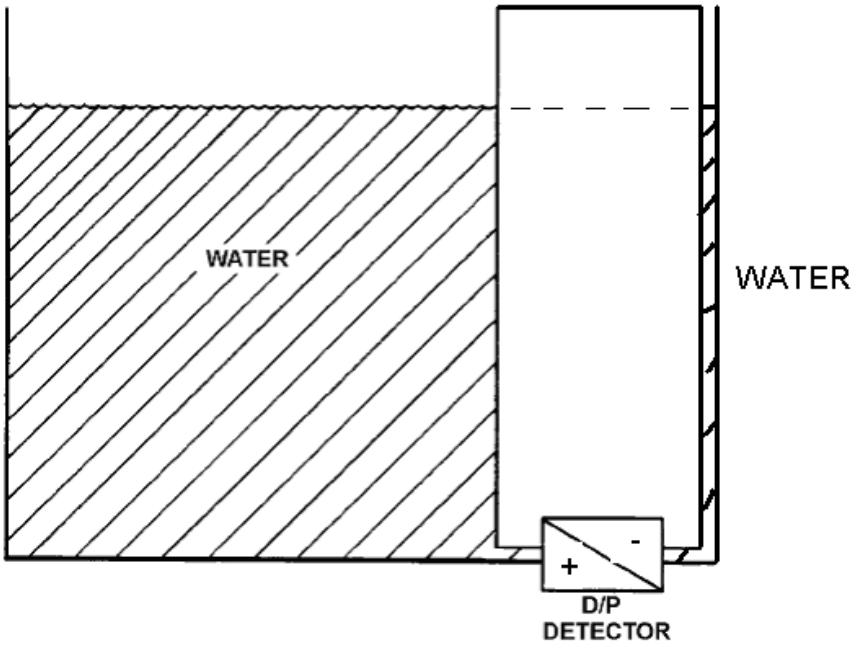
A. 13 feet
B. 17 feet
C. 21 feet
D. 25 feet



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

#8. Refer to the drawing of a tank with a differential pressure (D/P) level detector (see figure below). If the tank contains 30 feet of water at 60 ^{o}F and top of tank is open to atmosphere and the reference standoff pipe contains 30 feet of water at same temperature and is also open to atmosphere, what is the approximate D/P sensed by the detector?

A. greater than zero
B. zero
C. less than zero



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

#9. If flow is doubled through an orifice plate, what is the increase in differential pressure across the flow plate?

A. New differential pressure is same as original differential pressure
B. New differential pressure is 2 times original differential pressure
C. New differential pressure is 4 times original differential pressure
D. New differential pressure is 8 times original differential pressure

#10. For series – parallel combustion control system, the fuel flow primary control variable is _____ and the air flow primary control variable is _____.

A. Steam Pressure, Steam Flow
B. Steam Flow, Steam Pressure
C. Steam Pressure, Steam Temperature
D. Steam Temperature, Steam Pressure

#11. Utilizing conventional color codes, a motor operated valve that is the color “Light Red” on the HMI indicated that the valve is;

A. Full Open
B. Mid Travel (i.e. not full open and not full closed)
C. Full Closed

#12. Utilizing conventional color codes, a pump energized by a 3 phase motor that is the color “Light Red” on the HMI indicated that the pump is;

A. Energized and operating
B. In a faulted condition
C. De-energized

#13. A transducer is installed on a tank that is scaled to send a 4-20 mA signal proportional to a tank level of 4 feet to 20 feet (such that 4 feet = 4 mA and 20 feet = 20mA). At 5 different times, when the tank level was physically measured at 12 feet, the ideal output of the transmitter should have been 12mA, but actual output was 9mA all 5 times sample were tested.

Question is, is this transducer Accurate, Precise, both, or neither.

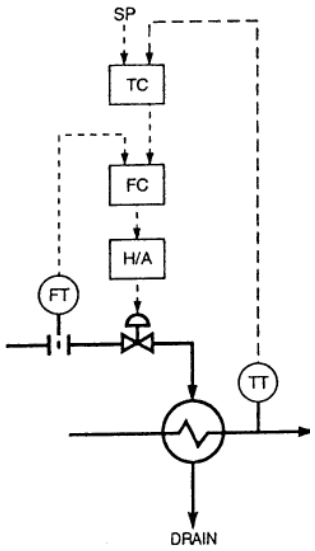
A. Very accurate but not very precise
B. Not very accurate but very Precise
C. Both accurate and precise
D. Neither accurate nor precise

#14. The formula given below represents the _____ function of a PID controller.

$$p = (1/T_i) \int E\, dt$$

A. Percent
B. Integral
C. Differential

#15. The control system shown below is an example of a _____ System.



A. Feedforward
B. Cascade
C. Feedforward & cascade

#16 What standard address boiler control and burner management system safety requirements

A. NEC
B. NESC
C. NFPA 70E
D. NFPA 85

#17 In a balanced draft boiler, the _____fan inlet damper (or fan speed) is used to control boiler pressure (vacuum).

A. Forced Draft
B. Induced Draft
C. Primary Air
D. Gas Recirculation

#18 In a balanced draft boiler, the _____ is used to control the fuel flow.

A. Primary Air fan damper or speed
B. Forced draft fan damper or speed
C. Induced draft fan damper or speed
D. Pulverizer speed