

**Job Responsibilities - Pneumatic symbols**

- Identifies graphic symbols for pressure control and flow control valves.
- Understands that port connections in directional control valve symbols count as ways or flow paths.
- Recognizes that blocked center, pressure center, and exhaust center are the most common center conditions for pneumatic control valves.
- Distinguishes between pneumatic blocked center, pressure center, and
- Recognizes flow paths through pneumatic directional control valves in exhaust center three-position directional control power valve symbols.
- Identifies symbols for directional control valves.
- Recognizes component operation from graphic symbol.
- Recognizes the purpose and function of its pneumatic excess flow control valve

**Job Responsibilities - Gas Laws**

- Converts temperature measurement between °F and °R.
- Converts pressure measurement between psi gauge and psia (absolute).
- Understands relationships given by Boyle's Law.
- Understands pressure, volume and temperature relationships given by the general gas law.
- Understands that the dew point of air is the temperature at which air is fully saturated with water.
- Determines the moisture content of air from pressure/temperature graphs.
- Understands the relationship between relative humidity, absolute humidity, and humidity at saturation.
- Understands the relationship between gauge pressure and compression ratio.
- Understands the relationship between height of a column of mercury and negative psi gauge reading.
- Determines the force and area relationships for vacuum pad applications.

**Job Responsibilities - Maintenance**

- Knows that flexible couplings are used to isolate compressor vibration from the air piping system.
- Computes the cost of air leakage in a compressed air system.
- Calculates the inch drop from percent grade for an air line.
- Associates the methods of removing moisture from compressed air with operating costs.

## Job Responsibilities - Components

- Knows that compressor delivery is expressed in cfm at ambient conditions, or scfm at standard conditions of 14.7 psia, 68 °F, and relative humidity of 36% (0.0750 density) conditions, or scfm at standard conditions of 14.7 psia, 68 °F, and relative humidity of 36% (0.0750 density).
- Understands that compressor cfm is measured flow rate at the intake
- (ambient conditions), and the scfm is calculated from measured flow
- rate (to standard conditions from ambient conditions).
- Recognizes the rule of thumb that for constant demand systems (receiver capacity equals the cfm delivery from the compressor at working pressure and ambient conditions).
- Computes air receiver capacity from constant (K) cfm delivery from the compressor, working pressure, and ambient conditions such that:
  - Associates friction factors with pressure losses in pneumatic valves.
  - Associates friction factors with pressure losses in pneumatic fittings.
- Predicts directional control valve operation from performance curves.
- Understands that the flow capacity of directional control valves is in direct proportion to the Cv factor.
- Calculates Cv and flow rates for pneumatic valves.
- Understands how pressure, air consumption rate, and time relate to air receiver size from the relationship.
- Calculates pressure drop in an air line.
- Understands pressure and area relationships as they affect cylinder output force.
- Computes the cfm required to power a double-acting air cylinder.
- Associates the type of pneumatic valve with the operation of the circuit.
- Understands that pneumatic signal output units (valves) must match working units (cylinders and motors).
- Recognizes that various signal output units (valves) can alter the operating characteristics of working units (actuators).
- Distinguishes between four-way and five-way plumbing of a four-way directional control valve.

## Job Responsibilities - Controls

- Recognizes that pneumatic limit valves signal the control system when an event has taken place.
- Identifies single-phase, single-phase two speed, and three phase AC electric motor symbols.
- Recognizes that air logic systems control the sequence of operations.
- Recognizes various air logic circuits.
- Identifies logic controls with logic circuits.
- Identifies basic electrical symbols in ladder diagrams.
- Understands that electrical contacts have negligible electrical resistance, whereas output elements have appreciable electrical resistance.
- Understands the interaction between a ladder diagram and directional control valves.
- Recognizes logic statements that describe ladder diagrams.
- Identifies equivalent logic statements from a truth table.
- Matches cylinder motion sequences with motion diagrams.

- Determines cylinder operation sequence from motion diagram.
- Understands the function of the Graetz rectifier.
- Identifies function of electrical components in a circuit.
- Understands that solenoid coil hum is caused by alternating current and the bias spring.
- Understands that the shading ring in AC directional control valve solenoids minimizes hum by providing an induced current that lags the applied current.
- Understands the relationship given by Ohm's law.

#### **Job Responsibilities - Basic Circuits**

- Understands that the spongy nature of air causes "stick slip" when moving heavy loads at slow speeds with air cylinders.
- Recognizes basic air circuits from circuit schematics.
- Analyzes component operation in basic air circuits.
- Understands that resistive loads are controlled in pneumatic circuits by meter-in circuits.
- Understands that tractive (overrunning) loads are controlled in pneumatic circuits by meter-out circuits.
- Understands pneumatic speed regulation circuits.
- Understands switching circuits for pneumatic branching operations.
- Distinguishes between will, time, pressure, sequence, and programmed pneumatic circuit control systems.

#### **Job Responsibilities - Troubleshooting**

- Understands that studying the circuit diagram is necessary to identify component function and sequence of operation.
- Associates slow air cylinder return with minimum (low) air pressure operating against the rod side of the piston.
- Associates the failure of an air cylinder to extend under load, but an ability to retract under load, with directional control valve failure, since the directional control valve is in the cylinder return position.
- Traces a fault backward from the working element (cylinder), to signal input pilot valves.
- Identifies component malfunction in a pneumatic system.
- Analyzes pneumatic circuits.