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Recommended Practice

Piping Guide For Control Centers

ISA-RP60.9, Piping Guide For Control Centers

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Preface

This Preface is included for information purposes and is not part of RP60.9.

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The ISA Standards and Practices Department is aware of the growing need for attention to the metric system of units in general, and the International System of Units (SI) in particular, in the preparation of instrumentation standards. The Department is further aware of the benefits to USA users of ISA Standards of incorporating suitable references to the SI (and the metric system) in their business and professional dealings with other countries. Towards this end this Department will endeavor to introduce SI-acceptable metric units in all new and revised standards to the greatest extent possible. *The Metric Practice Guide*, which has been published by the American Society for Testing and Materials as ANSI designation Z210.1 (ASTM E380-76, IEEE Std. 268-1975), and future revisions, will be the reference guide for definitions, symbols, abbreviation, and conversion factors.

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The SP60 Committee is preparing a series of recommended practices on control centers. ISA-RP60.9 is the second of this series to be published. The published recommended practices and drafts in preparation are listed below:

RECOMMENDED PRACTICE

SECTION	TITLE
dRP60.1*	Control Center (C.C.) Facilities
dRP60.2*	C. C. Design Guide and Terminology
dRP60.3*	Human Engineering for Control Centers
dRP60.4*	Documentation for Control Centers
dRP60.5*	Control Center Graphic Displays
dRP60.6*	Nameplates, Tags and Labels for Control Centers
dRP60.7*	Control Center Construction
RP60.8	Electrical Guide for Control Centers (published 1978)
RP60.9	Piping Guide for Control Centers (published 1981)

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dRP60.10*	Control Center Inspection and Testing
dRP60.11*	Crating, Shipping and Handling for C.C.

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1 Scope

This Recommended Practice is intended to assist the designer or engineer in the definition of piping requirements for pneumatic signals and supplies in control centers. This Recommended Practice is based on current practices. Because of the special nature of each control center, specific rules are not practical and accepted guidelines should take precedence. This Recommended Practice is a presentation of these guidelines.

Piping external to the control center (Field Piping) is beyond the scope of this document.

2 Definitions

2.1 Piping

For the purpose of this document, the term "piping" includes metal or plastic tube, pipe fittings, valves, and similar components, and the practice of assembling these items into a system.

2.2 Field piping

That piping connecting the control center to items external to the control center.

2.3 Direct process piping

That piping between the process and the control center which contains process fluid.

2.4 Signal piping

That piping interconnecting instruments, instrument devices, or bulkhead fittings.

2.5 Air

For the purposes of this document, air implies use of any suitable, and normally clean, dry, safe gas.

2.6 Pneumatic supply

Air at a nominally constant pressure used to operate pneumatic devices.

2.7 Signal air

Air at varying pressure used to represent process or control information.

3 General

3.1 Application

Piping is employed in control centers to convey air for two basic reasons: (a) that of supplying energy for the operation of instruments and other devices, and (b) that of transmission of information between instruments. Integrity of the piping system is essential to avoid loss of the pneumatic supply and degradation of the transmitted signals.

3.2 Reference standards or recommended practices

3.2.1 ISA-S7.3 Quality Standard for Instrument Air

3.2.2 ISA-RP42.1 Nomenclature for Instrument Tubing — Fittings (Threaded)

3.2.3 ISA-RP7.1 Pneumatic Control Circuit Pressure Test

3.2.4 ISA-S7.4 (SAMA* RC2-5) Air Pressures for Pneumatic Controllers and Transmission Systems

3.2.5 SAMA* RC19-10 Tubing Connection Markings for Pneumatic Instruments.

3.2.6 ISA dRP60.6** Nameplates, Tags and Labels for Control Centers

3.2.7 API*** RP 550, Part 1, Section 12 Control Centers

4 Pneumatic piping

4.1 Pneumatic supply

Supply air is usually delivered to the control center from external sources at pressures typically between 60 and 150 psi gage (400–1000 kPa). It should be clean, dry, and suitable for the application and environment. Refer to ISA-S7.3, "Quality Standard for Instrument Air." A sufficient flow of supply air should be available to meet the control center requirements for transient as well as steady state conditions. Displacement of oxygen in the control center or control room, resulting from the use of bleed type instruments when gases other than air are used, should be considered.

4.1.1 Pressure reducing station

A pressure reducing station (sometimes termed as "air set") reduces and regulates the supply air pressure to a level suitable for the application. The reduced pressure is usually 20 psi gage (140

*Scientific Apparatus Makers Association

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***American Petroleum Institute

kPa) for systems employing 3–15 psi gage (20–100 kPa) signal ranges and 40 psi gage (270 kPa) for 6–30 psi gage (40–200 kPa) signal ranges.

Pressure reducing stations are normally located inside of the control center, but can be external if special access requirements or space limitations exist.

4.1.1.1 Sizing

The number of air users in the control center establishes the capacity requirements. It is a common practice to determine the total instantaneous air usage by adding together the maximum consumption of each pneumatic device and multiplying by a safety or sizing factor of 1.3 to 2.0.

Air filters and pressure regulators are selected from manufacturers' capacity data based on the total adjusted instantaneous usage and required regulated pressure.

4.1.1.2 Design

An installation of dual pressure regulators and dual air filters is generally employed. They are arranged in parallel with appropriate valving so that one system can be serviced while the other is in use. (See Figure 1.) When 3-way valves are used, they should not interrupt supply to the instruments during a transfer from one leg to the other. Pressure gages should be provided in each leg to indicate the pressure of the regulated air. A pressure gage may also be installed to indicate the pressure of the supply air. A pressure gage with a blow-out back or disc and a plastic lens is recommended. Low air pressure alarms are often initiated from suitable pressure switches at the pressure reducing station. Adequate clearance is necessary to provide for service and maintenance of the system.

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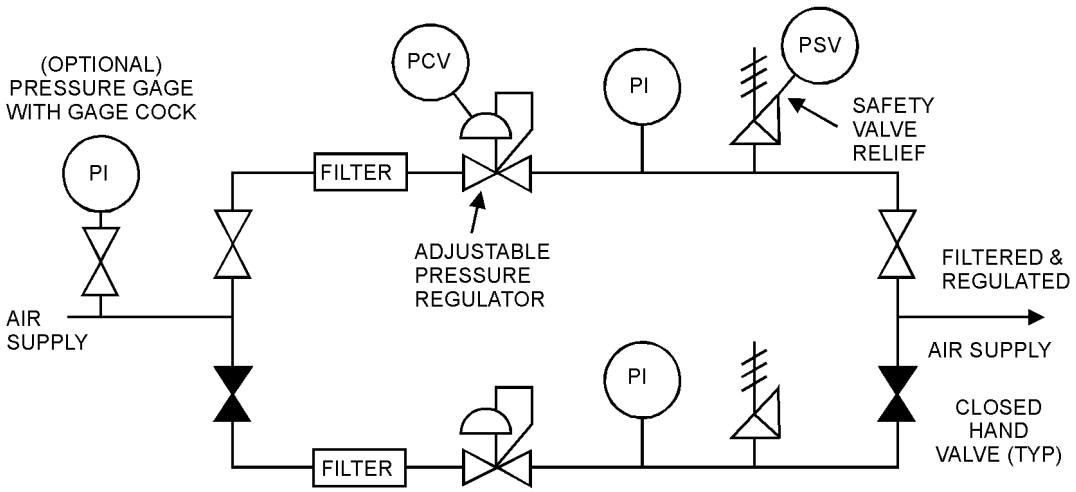

Figure 1 — Installation of dual pressure regulators and dual air filters

Combination filter-regulators can be employed where the air usage or service requirements permit. (See Figure 2.) On control centers with a few air users, a separate air filter and pressure regulator may be employed for each air user.

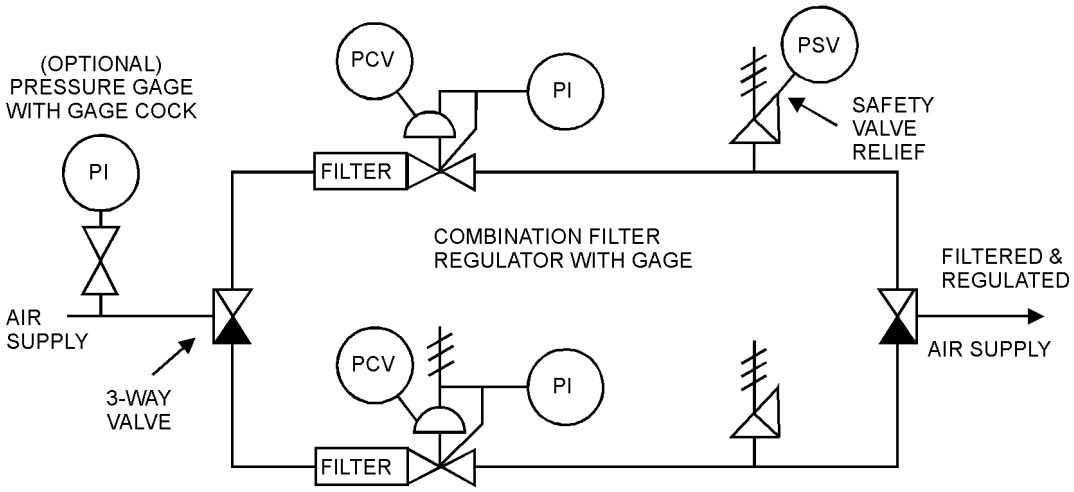

Figure 2 — Installation of combination filter-regulators

4.1.2 Regulated air supply header

The regulated air is normally piped to a larger diameter plastic or non-ferrous metal pipe section acting as a manifold or header and reservoir from which each air user receives its supply. The headers are normally installed in a horizontal or vertical plane in the lower part of the control center and have individual shut-off valves at each air supply take-off point. Each shut-off valve should be identified with a non-corrosive metal or plastic tag. Refer to ISA-dRP60.6 "Nameplates, Tags and Labels for Control Centers."* (See Figure 3.) It is a good practice to provide up to 15 percent spare valved connections. The assembly is normally mounted in a rigid manner, sloping at least 1/8 inch per foot away from the supply end, down toward a drain cock. If there is the possibility that failure of the pressure reducing station could result in over pressure damage to the air users, a suitably sized safety relief valve should be installed. (See Figures 1, 2, and 3.) The safety relief valve should be sized to pass the rated flow capacity of one regulator failing full open.

The individual air users are connected to the header shut-off valves by tubing. This supply tubing is typically 1/4 inch outside diameter soft copper, plastic, or stainless steel. Some devices with larger air usage may require supply tubing of 3/8 inch or 1/2 inch outside diameter, as suggested by the specifications for that device.

It is a general practice to increase the volume of the air supply header as the number of air users increases. To minimize the pressure drop across the air supply header during large transients in air demand, it is a common practice to use larger diameters and longer sections of pipe.

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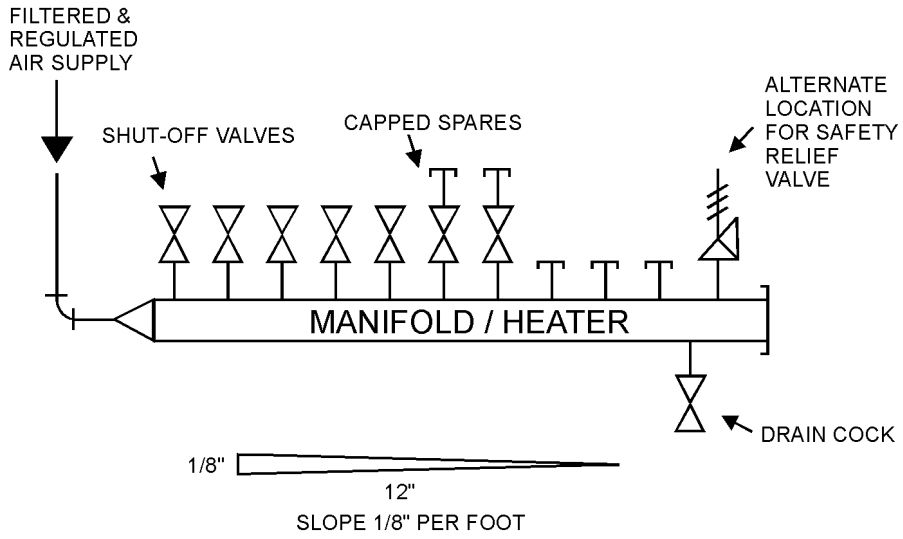

Figure 3 — Air supply header

4.2 Signal piping

Signal piping is typically 1/4 inch outside diameter (OD) metal or plastic tubing. The signal piping system often includes a test tee and isolating valve at each receiving device to facilitate testing, calibration, or maintenance.

4.2.1 Common materials

a) Soft Copper, 1/4 in. OD x 0.030 in. wall thickness

b) Polyethylene, 1/4 in. OD x 0.040 in. wall thickness

c) Aluminum, 1/4 in. OD x 0.032 in. wall thickness

d) Stainless Steel, 1/4 in. OD x 0.030 in. wall thickness

Certain applications may require plated or plastic coated metal tubing.

4.2.2 Labeling and color coding

Plastic or noncorrosive metal nametags should be attached to bulkhead fittings to identify signal source, application, and/or other information. Refer to ISA-dRP60.6, "Nameplates, Tags and Labels for Control Centers."* Color coded plastic tube can identify use of application, i.e.:

air supply — RED

transmitted measurement — ORANGE

controller output to valve, pneumatic set slave, etc., — YELLOW

seal (to remote mounted controller) — PURPLE

set (to remote mounted controller) — BLACK

*Draft Recommendation Practice, for additional information on the status of this document contact ISA Headquarters.

branch transmitted measurement to readout element — GREEN

branch transmitted measurement to readout element — BLUE

all others — NATURAL*

4.2.3 Routing and arrangement

All tubing installation should be in accordance with recognized good practices which generally provide that:

a) Metal tube runs should be routed horizontally and vertically with diagonal routing minimized.

b) All bends in metal tubing should be made with a tool designed for that purpose to prevent kinks or flattening.

c) Tubing runs should be routed to provide maximum access to control center interior for ease of maintenance and equipment removal.

d) Tubing runs should be grouped for mutual support and neat appearance and secured with noncorrosive metal gang straps. Plastic ties or straps can be used for bundling of plastic tubes or the tubes can be run in wireways.

e) Sharp bends in plastic tubes should be supported or protected to avoid kinks.

f) Test tees, isolating valves, and quick disconnects should be rigidly supported.

g) Tube fittings should be made up or installed in accordance with the manufacturer's recommendations.

h) An isolating valve should be provided at each receiver when one signal line serves two or more receiver instruments.

Piping and tubing terminations are normally accomplished through the use of fittings designed to provide leak-free connections. Flared or compression type fittings are normally employed for tube terminations. Refer to ISA-RP42. 1, "Nomenclature for Instrument Tubing-Fittings (Threaded)". Fittings are normally threaded for insertion into tapped pipe thread holes in instruments or other devices.

Plastic tubing terminations are normally the compression type. Special metallic tube fittings, including weld-type and solder-type, are commercially available for special applications.

4.3 Fittings

4.3.1 Bulkhead fittings

Bulkhead fittings provide a means for connection of field piping to the appropriate tube run inside the control center enclosure. Bulkhead connections can be installed inside the control center enclosure or through the outer surface. The bulkhead fitting normally includes a means for rigid attachment to the control center enclosure and connectors for attachment of tubes at each end.

*Uncolored or white pigmented plastic

4.3.2 Tube fittings

Tees, elbows, couplings, nipples, gage cocks, shut-off valves, and other tubing components, are commonly available in plastic, brass, certain alloys of stainless steel, and other metals. Material selection should normally be based on the application, operating pressures, flowing media, and ambient environmental conditions.

Pipe thread connections should be made leak proof by employing suitable sealing compounds or joint tape.

5 Direct process piping

Extra precautions are required when direct process piping is brought into a control center. Safety considerations should include reference to Federal, Provincial, State, and Local Codes, restrictions of appropriate regulatory agencies, and other authorities. Material selection, pipe sizes, types of fittings, shut-off valves, blow-down facilities, and other features, should adhere to the requirements of the operating conditions such as temperature, pressure, and corrosiveness of the measured fluid.

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