Series AK M60

Crossover Manifold

INSTALLATION AND OPERATION MANUAL

Part Number 00-15000012

Revision 1

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1. DESCRIPTION

This installation and operation manual covers the series AK M60 crossover manifold. The AK M60 crossover manifold is used to maintain a continuous supply of source gas when the "in use" gas cylinder is depleted, by automatically drawing gas from a standby cylinder. The AK M60 consists of a *crossover regulator* and *pressure gauges*. The crossover regulator has a panel nut for mounting. The crossover regulator consists of two regulators with separate inlets and a common outlet, machined into a single body. Two pressure gauges are installed in the crossover regulator to indicate the inlet pressure from the *Source A* and *Source B* gas cylinders. The crossover regulator has an outlet pressure gauge and an outlet port. A relief valve is recommended to be installed to protect the low pressure side of the crossover regulator from full cylinder pressure in the event of a seat failure. Custom configurations may vary slightly from this standard design. Figure 1 shows the basic design.

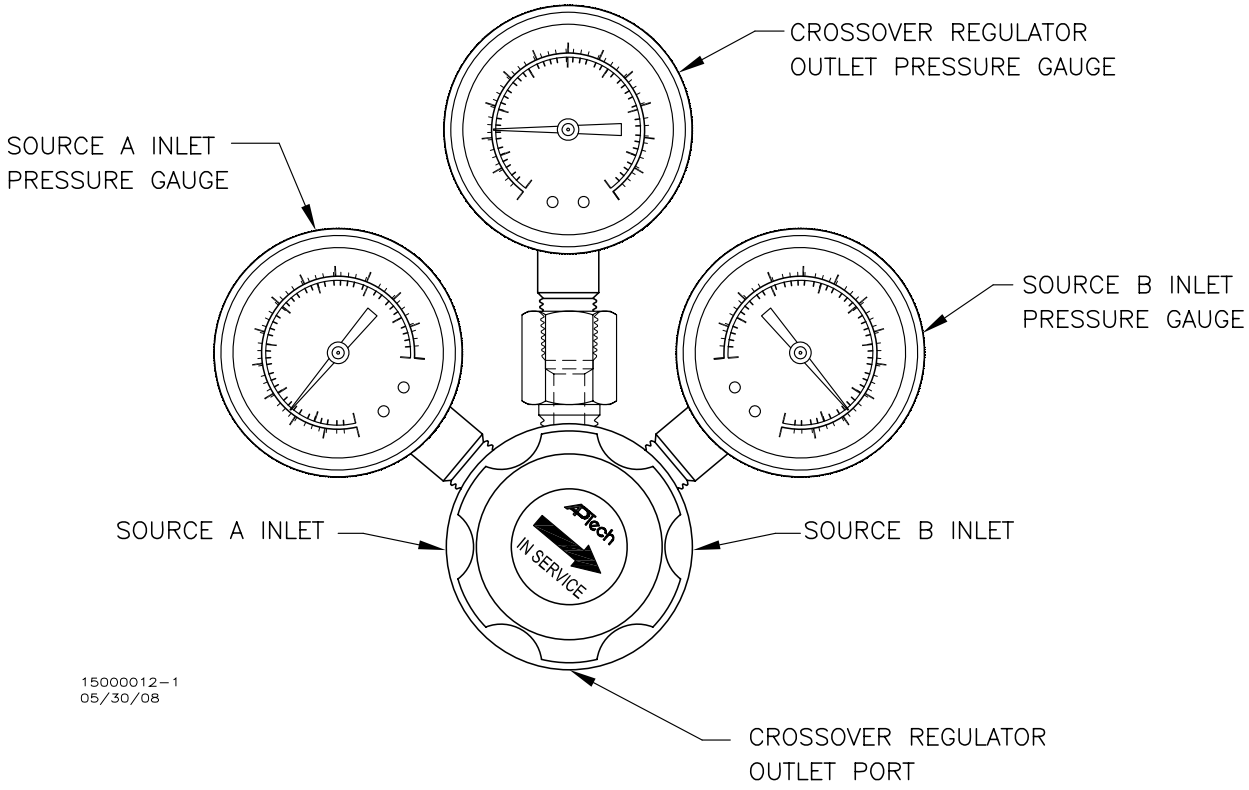

Figure 1. AK M60 Crossover Manifold Front View

2. SAFETY

The user is strongly recommended to carefully read this section covering general safety information and to adhere to specific safety information located throughout this manual.

2.1. General Safety Information

All technicians that install, operate, or maintain this equipment should be trained in the use and hazards of compressed gases. Technicians should also be familiar with the hazards associated with the particular gas being delivered. These hazards can include high pressure, asphyxiation, toxicity, flammability, corrosivity, etc. Material safety data sheets are available from gas suppliers that provide detailed information on the hazards associated with a particular gas.

Appropriate personal protective equipment should be worn at all times as recommended by the material safety data sheet for the particular gas and as required by safety practices at the installation site. This equipment may include safety glasses, safety shield, rubber gloves, aprons, etc.

Never exceed the maximum working pressure of the equipment.

Equipment shall be installed in a manner that meets local, state, and federal regulations and safety guidelines. General guidelines for compressed gases can be obtained from the Compressed Gas Association (http://www.cganet.com/) and the European Industrial Gases Association (www.eiga.org).

Prior to disassembling manifold lines, the system may need to be purged using nitrogen or another gas to remove any hazardous gases. The AK M60 system does not have built-in purging capability, which is the responsibility of the user.

2.2. AK M60 Crossover Manifold Specific Safety Information

An overpressure relief device should be installed in a tee off the outlet port (6:00 o'clock position) of the crossover regulator. The outlet of the relief device should be connected to a scrubber system or directed away from personnel as appropriate.

The AK M60 crossover manifold should be checked for leaks upon installation and inspected periodically during use.

A shut off valve and check valve should be installed between both supply cylinders and the AK M60 crossover manifold inlet connections to prevent gas escaping from the cylinder in use when a cylinder is being replaced.

Installation of purge and vent valves are recommended when used with hazardous gases and exposure to the gas can result in a safety hazard to personnel. Purge equipment is the responsibility of the user.

3. TECHNICAL SPECIFICATIONS

3.1. AK M60 Specifications

3.1.1. Physical

- Dimensions are approximately 6-1/2 inch wide by 6-1/8 inch high by 8-1/2 inch deep
- Weight is approximately 5 lbs.
- Recommended to be panel mounted in 1-27/64 (1.42) inch diameter hole

3.1.2. Pressure and Flow

- 3500 psig maximum inlet pressure (can be limited by inlet gauge range)
- 250, 150, and 100 psig nominal outlet pressure options (specified when ordered)
- 75 slm nitrogen maximum flow at 200 psig minimum inlet pressure (higher flow rates may be obtainable depending on inlet pressure and system components)

3.2. AK M60 Facility Requirements

The following is needed to install the AK M60 manifold at the users facility.

- 1/4 inch NPT adapters
- Secure mounting of the AK M60 to prevent loosening of fittings during operation of the knob

The recommended method of mounting the AK M60 manifold is with the panel mount feature. The panel mount feature requires a 1-27/64 (1.42) inch diameter hole in a .30 inch maximum thickness panel. The rear bonnet of the regulator is placed through the panel and secured in place with a panel nut as shown in Figure 2. Alternately, it is possible to design a custom bracket that could secure the AK M60 manifold to a fixed object.

The following is recommended for proper operation of the equipment:

- Check valve for installation between each supply cylinder and each AK M60 inlet port
- Manual valve for installation between cylinder and check valve
- Appropriate purge and vent system for hazardous gases
- Relief valve for installation on outlet delivery line

4. INSTALLATION

This section describes how to install the equipment at a user facility.

4.1. General

Use Teflon® pipe thread tape on NPT connections. When mating a 316 stainless steel pipe fitting to a 316 stainless steel AK M60 body, it is recommended that Teflon tape be applied to the first NPT thread to prevent galling upon assembly. For brass fittings, do not apply thread tape to the first NPT thread to reduce the chance of introducing pieces of thread tape into the system. Use care not to apply Teflon tape such that loose tape will come free and enter the flow path.

AP Tech recommends the use of Teflon tape for NPT connections to reduce the chance of galling 316 stainless steel threads, to maintain oxygen compatibility, and to maintain system cleanliness. Other types of sealants can be used, but may not provide the same results.

Do not drop or jar the switchover manifold because damage to internal parts and pressure gauges may result.

Inspect the manifold after unpacking and before installation. If any damage is observed, contact factory for repair.

4.2. AK M60 Installation

Select a location for the manifold that is sheltered from the environment and away from sources of heat or sparks. The area should be protected from vehicles and moving mechanical equipment. The area must be accessible for ease of cylinder replacement.

A panel or bracket with a 1-27/64 inch hole is recommended to secure the AK M60 crossover manifold and prevent movement during operation. Refer to Figure 2 for mounting location.

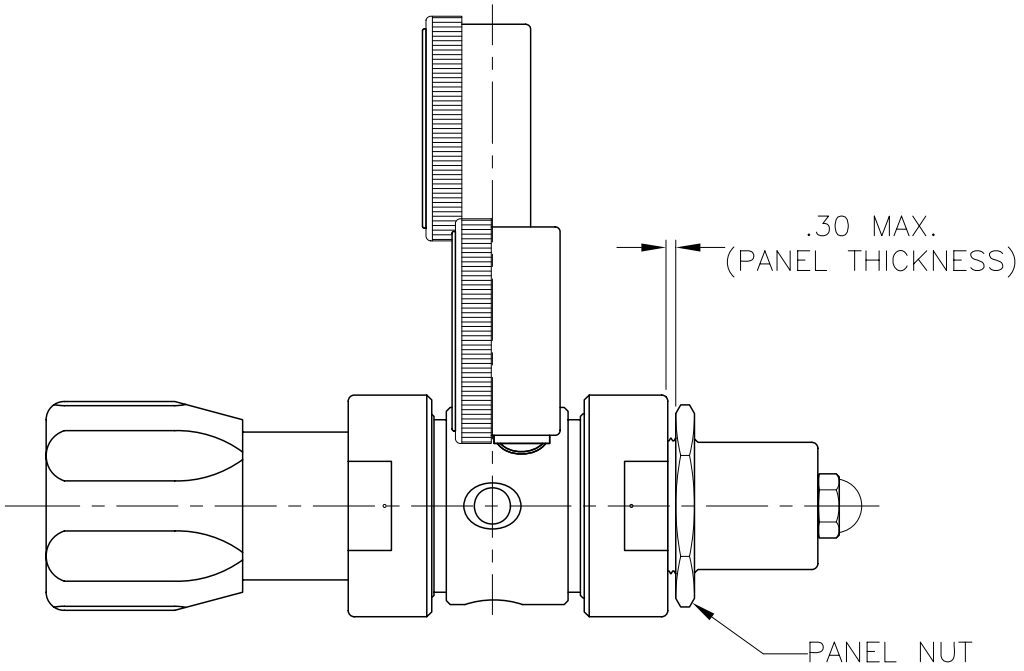

Figure 2. AK M60 Crossover Manifold Panel Mounting Detail

4.3. Connect Gas Lines to M60

Refer to Figure 3 for a schematic of the recommended installation that shows the relative location of the AK M60 crossover manifold and other components. AP Tech recommends both a check valve and manual valve are used to isolate each gas cylinder from the AK M60 crossover manifold. It is possible to isolate the AK M60 manifold from each gas cylinder using only either a check valve or a manual valve.

The *Source A* high pressure inlet ports are labeled with "HP-A" marked into the body. Arrows are used next to the HP-A to point toward the high pressure gauge port and the high pressure inlet port. The *Source B* high pressure inlet ports are similarly labeled with "HP-B" and arrows.

The low pressure outlet ports are labeled with "LP" marked into the body near the port. Arrows are used next to the LP to point toward the low pressure port (both the outlet pressure gauge port and outlet port).

Position a gas cylinder on each side of the AK M60 manifold. Secure cylinders in place using an appropriate restraint system.

Equipment can be supplied with various types of fittings and connections. The standard connections are 1/4 inch female NPT. Inspect the system to determine if the connection is NPT, tube compression, or other.

Install a check valve into port labeled "HP-A" on AK M60 manifold. Flow arrow on check valve should be pointing into the AK M60 manifold inlet port. Install a manual shut off valve onto check valve.

Install a check valve into port labeled "HP-B" on AK M60 manifold. Flow arrow on check valve should be pointing into the AK M60 manifold inlet port. Install a manual shut off valve onto check valve.

Connect a "pigtail" (bent piece of tubing with loops for flexibility and to reduce stress on connections) or flexible braided hose from the outlet of the left cylinder valve to the manual valve on the AK M60 manifold regulator inlet port labeled "HP-A".

Connect a "pigtail" (bent piece of tubing with loops for flexibility and to reduce stress on connections) or flexible braided hose from the outlet of the right cylinder valve to the manual valve on the AK M60 manifold regulator inlet port labeled "HP-B".

Install appropriate fitting into AK M60 manifold 1/4 inch NPT female outlet port. Install delivery line to point of use using tubing or piping. A tee should be placed on the delivery line close to the AK M60 manifold for installation of a relief valve.

4.4. Relief Valve Installation

Install a relief valve on one leg of tee installed as part of the delivery line. The relief valve should be set above the AK M60 crossover regulator pressure settings. See Table 1 for recommended nominal relief valve set pressures. If necessary due to gas properties, route the relief valve outlet line to an appropriate scrubber or exhaust system. Otherwise, direct the relief valve outlet away from personnel.

AK M60 Model	Nominal Crossover Regulator Outlet Range	Relief Valve Set Pressure
AK M6010	85-115 psig	150 psig
AK M6015	135-165 psig	200 psig
AK M6025	225-275 psig	325 psig

Table 1. Crossover Relief Valve Nominal Set Pressures

4.5. Purge and Vent Equipment

If required due to gas properties (such as for hazardous gases), install purge and vent valves to enable the operator to remove hazardous gases from the lines using an inert purge gas before connecting and disconnecting gas cylinders.

4.6. Initial Leak Test

Note: Depending on the application, the user may opt for skipping the initial leak test and connect the process gas cylinders. A leak test should be performed as described in 5.1.2 as part of the initial pressurization.

Connect a nitrogen (or other appropriate inert gas) cylinder with a pressure regulator to the pigtail lines connected to the AK M60 manifold *Source A* and *Source B* inlet ports using appropriate adapter fittings. Regulate the pressure to less than the manifold maximum inlet pressure and no more than 90% of the inlet gauge maximum range.

Pressurize the manifold with nitrogen and then isolate the supply gas cylinder.

Check all lines for leaks by listening for audible leakage and applying soap solution to NPT connections. Monitor the pressure gauges on the AK M60 manifold for a pressure drop that would indicate a leak.

If any leaks are found, then disassemble, repair, and retest.

Disconnect the nitrogen cylinder.

5. OPERATION

This section describes operation of the AK M60 crossover manifold.

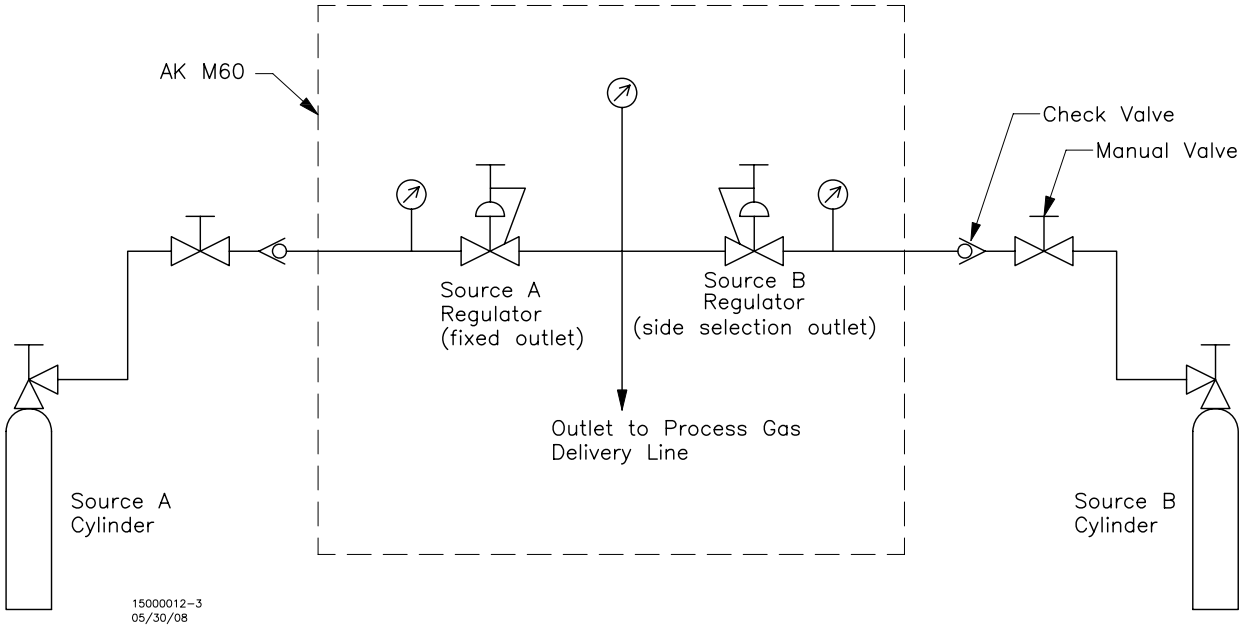

Figure 3. AK M60 Installation Schematic

5.1. AK M60 Operation

5.1.1. General Principle of Operation

The knob for the crossover regulator has an "IN SERVICE" label with an arrow. When the knob is turned so that the arrow points toward the *Source B* (right) cylinder (approximately the 4:30 o'clock position with the outlet pressure gauge at 12:00 o'clock position), then the *Source B* (right) cylinder is the primary gas supply and the *Source A* (left) cylinder is the standby gas supply. This knob position is shown in Figure 1. When the knob is turned so that the arrow points toward the *Source A* (left) cylinder (approximately the 7:30 o'clock position), then the *Source A* (left) cylinder is the primary gas supply and the *Source B* (right) cylinder is the standby gas supply.

The crossover regulator is comprised of a fixed outlet pressure regulator and an adjustable (limited range) outlet pressure regulator. The *Source A* (left) cylinder supplies the fixed outlet pressure regulator. The *Source B* (right) cylinder supplies the adjustable outlet pressure regulator. The adjustable outlet pressure regulator has the "source selection outlet" knob with the "IN SERVICE" label and arrow. This regulator can be rotated only 270 degrees to adjust the *Source B* outlet pressure slightly above or slightly below the *Source A* fixed outlet pressure. It is this slight change in *Source B* outlet pressure that *selects* which cylinder is supplying gas and which cylinder is on standby. When the cylinder supplying gas is depleted, then it is time to replace that cylinder using the protocol in Section 5.1.3 or 5.1.4 as appropriate.

5.1.2. Initial Pressurization with Process Gas

Confirm that an initial leak test has been performed and all leaks repaired.

Close all system valves.

Rotate source selection knob on AK M60 crossover regulator clockwise until internal stop is contacted. The knob will rotate approximately 270 degrees. The “IN SERVICE” label arrow on the knob should be pointing toward the *Source B* (right) cylinder (approximately the 4:30 o’clock position).

Open *Source B* cylinder valve and manual valve between *Source B* (right) cylinder and AK M60 crossover manifold. Pressure on *Source B* (right) gauge should indicate the cylinder pressure.

Open *Source A* cylinder valve and manual valve between *Source A* (left) cylinder and AK M60 crossover manifold. Pressure on *Source A* (left) gauge should indicate the cylinder pressure.

Check all system connections for leaks. This can be done with soap solution on each connection, by listening for an audible hissing sound, using an appropriate gas detector, or a pressure decay test that monitors system pressure gauges.

5.1.3. Source B (right) Cylinder Depleted

Confirm that *Source B* (right) cylinder is depleted by reading the pressure gauge. The exact pressure will depend on the specific AK M60 model. The approximate pressure when the *Source B* cylinder is depleted is given in Table 2.

Rotate source selection knob on AK M60 crossover manifold counterclockwise until internal stop is contacted. The knob will rotate approximately 270 degrees. The “IN SERVICE” label arrow on the knob should be pointing toward the *Source A* (left) cylinder (approximately the 7:30 o’clock position).

Close *Source B* (right) cylinder valve and manual valve between *Source B* (right) cylinder and AK M60 crossover manifold. If required, operate equipment to purge line from cylinder to manifold.

Disconnect depleted *Source B* cylinder and connect full cylinder.

Open *Source B* (right) cylinder valve and manual valve between *Source B* (right) cylinder and AK M60 crossover manifold. Pressure on *Source B* (right) gauge should indicate the full cylinder pressure.

AK M80 Model	***Source B* Depletion Pressure, psig**
AK M6010	100
AK M6015	150
AK M6025	250

Table 2. Approximate *Source B* Cylinder Depletion Pressure

5.1.4. Source A (left) Cylinder Depleted

Confirm that *Source A* (left) cylinder is depleted by reading the pressure gauge. The exact pressure will depend on the specific AK M60 model. The approximate pressure when the *Source A* cylinder is depleted is given in Table 3.

Rotate AK M60 crossover manifold “selection” knob clockwise until internal stop is contacted. The knob will rotate approximately 270 degrees. The “IN SERVICE” label arrow on the knob should be pointing at approximately 4:30 o’clock position toward the *Source B* (right) cylinder.

Close *Source A* (left) cylinder valve and manual valve between *Source A* (left) cylinder and AK M60 crossover manifold. If required, operate equipment to purge line from cylinder to manifold.

Disconnect depleted *Source A* cylinder and connect full cylinder.

Open *Source A* (left) cylinder valve and manual valve between *Source A* (left) cylinder and AK M60 crossover manifold. Pressure on *Source A* (left) gauge should indicate the full cylinder pressure.

AK M60 Model	***Source A* Depletion Pressure, psig**
AK M6010	85
AK M6015	135
AK M6025	225

Table 3. Approximate *Source A* Cylinder Depletion Pressure

6. TROUBLESHOOTING

The most common problem conditions and possible causes/corrections are described below. Please contact the factory for assistance with other problem conditions or to discuss a specific problem in more detail.

6.1. External leak

Possible causes:

Connection not assembled properly with Teflon tape.

Connection not tightened properly.

Correction:

Inspect equipment to determine source of the leak. Repair leak by disassembling the connection, inspecting parts, and reassembling using good shop practice.

If the leak is from the bonnet of the regulator, then AP Tech recommends that the AK M60 manifold be sent back to the factory for repair. However, a field repair kit is available.

6.2. Relief valve is opening and venting gas

Possible causes:

Relief valve opens below set pressure.

High delivery pressure (see section 6.3).

Correction:

Verify relief valve is opening below set pressure by checking pressure on outlet gauge. If gauge reading is within range listed in Table 1, then remove and bench test relief valve. Replace relief valve if defective.

6.3. High delivery line pressure

Possible causes:

Other gas source from point of use is pressurizing delivery line.

Seat leak or high creep on AK M60 crossover regulator.

Correction:

Check to see if a different gas source can be pressurizing the line.

If another gas source is not the cause of the high delivery line pressure, then it is likely the AK M60 crossover regulator has a seat leak or high creep and AP Tech recommends that the AK M60 manifold be sent back to the factory for repair. However, a field repair kit is available.

6.4. Low delivery line outlet pressure

Possible causes:

Flow restriction.

High flow at point of use

Correction:

Shut off the supply to the point of use and see if the line outlet pressure returns to normal setting. If outlet pressure returns to normal, then high flow or a flow restriction is the likely cause. Check the flow requirement at the point of use.

6.5. Both cylinders empty simultaneously

Possible causes:

External leak on high pressure connection from standby cylinder to AK M60 crossover manifold.

Vent valve leaking past seat (if installed).

High flow at point of use.

Seat leak on crossover regulator supplied by standby gas cylinder.

Correction:

Check for external leaks especially on the high pressure line from the standby cylinder to the AK M60 crossover manifold.

If there is a vent valve on the line from the gas cylinder to the AK M60 crossover manifold, check to see if the vent valve is leaking across the seat.

Verify the flow demand is below the manifold rating. In general, high flow will empty the “IN SERVICE” cylinder faster than the standby gas cylinder.

Momentarily shut off the cylinder valve on the standby gas cylinder. If the pressure on the standby gas cylinder pressure gauge drops, then high flow demand or a seat leak on the regulator supplied by the standby gas cylinder is the probably cause.