

BUREAU OF RECLAMATION
FACILITIES INSTRUCTIONS, STANDARDS & TECHNIQUES
Volume 5-3

HIGH PRESSURE SYSTEMS

High Pressure Systems

There is a potential danger inherent in high-pressure pneumatic and hydraulic equipment at power facilities. Personnel should be familiar with protecting, securing, and identifying high-pressure pipelines. Equipment is considered to be "high-pressure" if any part of it operates at 1400 kPa (200 lb/in²) or above. A large segment of the high-pressure systems are associated with air operated power circuit breakers. The power circuit breakers normally have two to four different pressure stages. These pressure stages, the pipe sizes, and the construction materials vary with each manufacturer. Repair must be made in accordance with each power circuit breaker manufacturer's specifications using properly rated fittings, valves, piping, and special components. Underrated materials cannot be safely used, even for temporary or emergency repairs.

One example of a violent failure of a high-pressure system involved an 18000-kPa (2600-lb/in²) air pipe which worked out of a fitting. The loose pipe was directed toward the ground and blew a hole 0.6 m (2 ft) deep into the ground. Yard rock and sandy soil were blown around and could have easily injured or killed anyone in the vicinity. High-pressure systems therefore should be considered as potentially dangerous as high-voltage electricity, and should be treated with equal caution. Operation and maintenance personnel should therefore be familiar with hazards of high-pressure pneumatic and hydraulic systems, and with the common-sense practices associated with them. All damaged or faulty high-pressure pipelines should be reported immediately and repaired as soon as possible. Work on any high-pressure system should be scheduled in conjunction with other work on major equipment and compressors. The following general practices should be used for inspecting, protecting, securing, and identifying high-pressure systems.

1. PERMANENT LINES

PROTECT. - Exposed high-pressure pipelines that could be easily damaged must be protected. The exact method of protecting and securing these pipelines depends on the installation. Protecting pipelines against extremes such as rifle fire is not economically feasible; however, they should be protected against normal stresses such as impact and bending. Any high-pressure pipe or equipment which could possibly be hit by a vehicle should be protected by strong posts or other barricades. Protect pipelines with angle steel welded or bolted to the power circuit breaker support structure, or other strong supports. Where possible keep the pipe within the angle of the steel.

DO NOT WELD ANY PIPE OR HIGH PRESSURE TANK. - This could weaken the strength of the pipe or tank. Fabricate protective covers from standard 50-mm (2-in) square mesh welded wire fabric. These covers should be used whenever possible, to shield groups of exposed high-pressure pipes or valves. Open-mesh covers are preferred over solid covers, because they let most of the high pressure force dissipate but retain the solid pieces. A solid cover which cannot dissipate the full force, could itself be propelled through the air.

SECURE. - Where impractical to cover long, exposed, high-pressure pipelines, secure them to sturdy members at intervals ([see table](#)) to limit any whipping action that might occur if a pipe failed. Strap pipelines to strong supports close to fittings, bends, and on either side of couplings. Place a piece of rubber or neoprene gasket material between the strap and the high-pressure pipe to help prevent failure from wear due to vibration or hammer caused by motion of the high-pressure fluid. Suggested support intervals are given in [Table 1](#). High-pressure air hose in overhead gutters should be secured at least every 0.9 m (3 ft). Gutters should be either without cover or with welded mesh fabric covers.

Table I - Suggested Intervals for Pipe Supports												
Pipe size		3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6
Interval (maximum)	(ft)	10	10	15	15	15	20	20	25	25	25	30
	(m)	3	3	4.5	4.5	4.5	6	6	7.5	7.5	7.5	9

IDENTIFY. - After high-pressure pipe has been protected, paint all exposed pipe yellow. If further identification is desired, stencil the information onto the pipe in black letters, or wire permanent metal tags to the pipe. For example the labels should read:

COMPRESSED AIR _____ kPa
(_____ lb/in²), or

HIGH PRESSURE _____ kPa
(_____ lb/in²).

2. TEMPORARY HOSES

Temporary high-pressure air hoses are usually used during maintenance, or during emergency breakdown of a compressor. Normally the hose is laid on the ground from a compressor to the power circuit breaker high-pressure storage tank.

PROTECT. - if hose has to be laid across a roadway, protect it from vehicular traffic. Construct a protective conduit from materials such as 2-by-4's with a narrow sheet of plywood nailed to the bottom, and lay it on the ground the complete width of the roadway, and lay the hose between the 2-by-4's. Thus, vehicle tires will not hurt the hose or force it into the rough road bed. Generally protect the hose from all sharp rock.

SECURE. - Tie the ends of the hose, and at regular intervals along the hose, to heavy stationary equipment and yard structures with rope. Where the hose is laid on the ground, place sand bags or equivalent on the hose at about 3-m (10-ft) intervals.

IDENTIFY. - If the hose is to be placed for 3 days or more, place the following warning sign at every high-traffic route for both foot and vehicular traffic:

COMPRESSED AIR _____ kPa
(_____ lb/in²).