

Fire Management Tech Tips

United States Department of Agriculture
Forest Service



Technology & Development Program

June 1998

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9851 1305—SDTDC

CONTROLLING DOWNHILL WATER PRESSURE IN HOSE LAYS

by

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BACKGROUND

Region 5 hotshot crews have experienced the rupturing of fire hose due to excessive pressure when working fires with long downhill hose lays. Burst fire hose results in loss of fire line construction, loss of efficiency in mop-up, and most importantly—the loss of protection for firefighters constructing or holding fire line.

PROBLEM

It is impossible to accurately assess hose pressure by viewing or feeling the hose. There must be a method to accurately monitor hose pressure and a method to reduce the pressure if it is found to be excessive.

Excessive pressure is the result of the change in downhill elevation from the water source (engines, water tenders, fold-a-tanks) to the nozzle of the hose lay. For each one-foot of downhill elevation, pressure increases by 0.43 pounds per square inch (psi). It is also important to note, hose diameter has little effect on excessive pressure. If water is flowing in the hose, the diameter of the hose can have some effect on pressure build up. If no water is flowing through the hose, the size of the hose has no effect on pressure build up, only change in elevation.

Fire hose purchased by the Forest Service is qualified with a minimum burst pressure of 900 psi and a factory proof pressure of 450 psi. After the hose has been used on a fire, it is refurbished by the fire cache, and generally tested to 300 psi, and returned to storage for future use.

Firefighters have reported hoses bursting at about 300 psi. Consequently, it is recommended—to ensure reliability of the hose—pressures below 300 psi be

maintained. A downhill elevation loss of 700 foot in a hose lay can be completed before a pressure of 300 psi is reached. When working downhill hose lays, firefighters should be aware of the elevation drop so the necessary fittings can be installed to reduce the pressure. The reduction in pressure ensures water is available for firefighting operations further down the fireline.

SOLUTION

San Dimas Technology and Development Center (SDTDC) has devised a simple, low-cost method of monitoring pressure and reducing the pressure when excessive. SDTDC recommends reducing the pressure to between 50-125 psi when downhill pressure approaches 300.

A low cost pressure gauge along with some standard fire hose fittings can be used to determine, with acceptable accuracy, when pressure in a downhill hose lay is building too high (see figures 1 and 2). If the downhill pressure is approaching 300 psi and the hose lay will continue downhill, building more pressure, a pressure reducing valve can be installed in the hose lay at the point where the pressure is approaching 300 psi (see figure 3).

The pressure reducing valve will reduce the pressure from 300 psi to 50 psi allowing an additional 581 foot drop in elevation before reaching an unacceptable pressure in the hose (300 psi).

This pressure reducing valve can be equipped with a fire hose female swivel on the inlet and a male hose thread adapter on the outlet making it possible for the pressure reducing valve to be easily placed anywhere in the hose lay.



By using a pressure gauge to detect an unacceptable level of pressure built in a downhill hose lay and a pressure reducing valve to control the pressure level, the rupture of Forest Service specification hose when used in a downhill hose lay can be avoided. The cost savings for hose replacement could be significant if monitoring hose pressure becomes second nature on the fireline. The gauges and hose fittings described below are all available through normal procurement methods.

Figures 1 and 2 illustrate methods of determining downhill pressure.

Pressure Gauge:
0-600 psi,
2-1/2 inch diameter,
1/4 inch NPT Lower
Connected, Granger Part
Number P505K- 600LM,
1X780; approximate cost
\$5.50.

Nozzle Tip:
Tap 3/8 inch
straight stream
x 3/4 inch 11-1/2 NH
Nozzle Tip, NFES
Number 0638, with
1/4 inch female NPT by
drilling out to 7/16 inch
and tapping with a 1/4
inch NPT tap; approx-
imate cost \$4.31.

1-inch Reducer:
Reducer, 1 inch 11-1/2
NPSH x 3/4 inch 11-1/2
NH, NFES Number 0733; →
approximate cost \$5.03.

1-1/2 inch Reducer:
Reducer, 1-1/2 inch 9NH
x 1 inch 11-1/2 NPSH, →
NFES Number 0010;
approximate cost \$5.66.

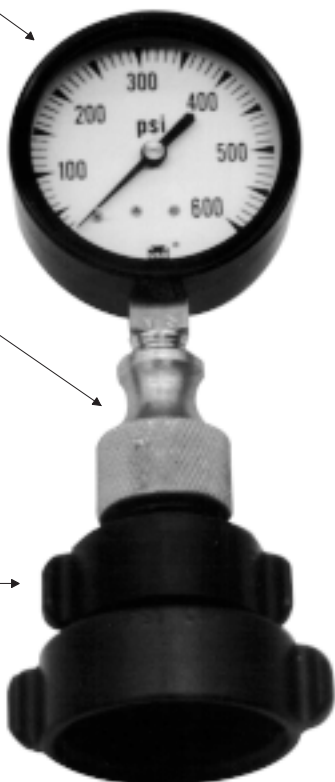


Figure 1. Pressure gauge set-up with pipethread tapped nozzle.

Pressure Gauge:

Bushing, Brass,
1/4 inch NPT female
x 1/2 inch NPT male;
approximate cost \$1.00.

**Adapter, brass, 1/2 inch
NPT female x 3/4 inch 11-
1/2 NH female;**
approximate cost \$3.00.
*Note: Be sure adapter is
solid brass and does not
have a swivel. A swivel
adapter may not stand the
pressure.*

1-inch Reducer:
Reducer, 1 inch 11-1/2
NPSH x 3/4 inch 11-1/2
NH, NFES Number 0733;
approximate cost \$5.03.

1-1/2 inch Reducer: →
Reducer, 1-1/2 inch 9 NH
x 1 inch 11-1/2 NPSH,
NFES Number 0010;
approximate cost \$5.66.

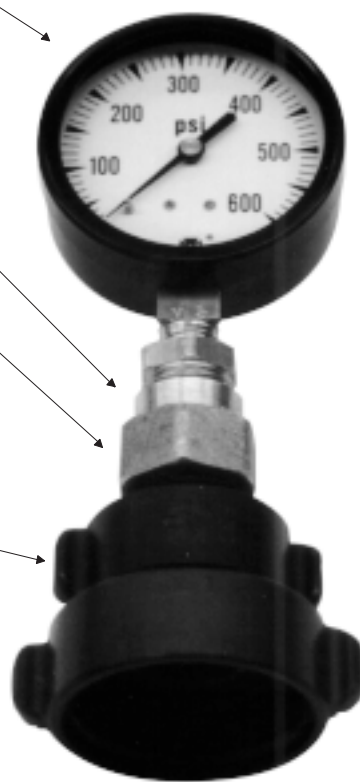


Figure 2. Pressure gauge set-up with brass reducers.

Figure 3 illustrates a 1-1/2 inch pressure reducing valve. This valve is used to reduce excessive downhill pressure.

Pressure Reducing Valves can be purchased from:
A.W. Cash Valve Mfg. Corp. Phone (205)-775-8200.
Type 41 factory set at 45 psi and reset to 50 psi
with a 20 - 70 psi spring. Approximate cost \$375.00.

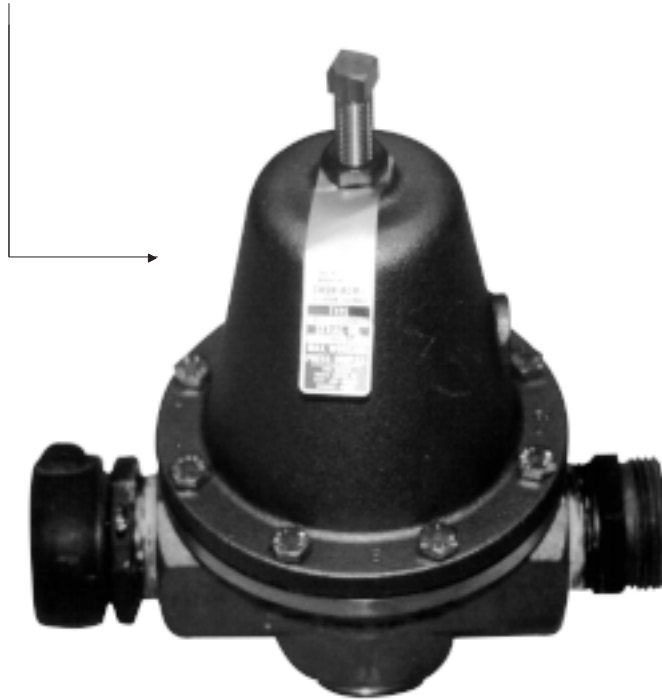


Figure 3.—Pressure reducing valve —1-1/2 inch.

CONCLUSION

Knowing how to monitor and control downhill water pressure in hose lays will ensure that the firefighter has all the tools to build safe fireline. All items listed above are readily available and can be purchased at a reasonable cost.