River Bend Transfer Systems, LLC

HOSE TESTING METHODS

(Reprinted from RMA Hose Handbook IP-2 Sixth Edition 1996)

SAFETY WARNING: Testing can be dangerous and should be done only by trained personnel using proper tools and procedures. Failure to follow such procedures might result in damage to property and serious bodily injury.

The Rubber Manufacturers Association (RMA) recognizes, accepts and recommends the testing methods of the American Society for Testing and Materials. (ASTM)

Unless otherwise specified, all hose test are to be conducted in accordance with ASTM Method No. D-380 (latest revision). Where and ASTM D-380 test is not available, another test method should be selected and described in detail.

RMA participates with ASTM under the auspices of the American National Standards Institute (ANSI) in Technical Committee 45 (TC45) of the International Organization for Standardization (ISO) in developing both hose product and hose test method standards. Many of the hose test methods standards published by ISO duplicate or closely parallel those shown in ASTM D-380. Many are unique and in those cases, the RMA may be able to provide the necessary test standard references which may be purchased from the American National Standards Institute.

HYDROSTATIC PRESSURE TESTS

Hydrostatic pressure tests are classified as follows:

1. DESTRUCTIVE TYPE
   a. Burst test
   b. Hold test

2. NON DESTRUCTIVE TYPE
   a. Proof pressure test
   b. Change in length test (elongation or contraction)
   c. Change in outside diameter or circumference test
   d. Twist test

Destructive Tests

Destructive tests are conducted on short specimens of hose, normally 18 inches (460 mm) to 36 inches (915 mm) in length and, as the name implies, the hose is destroyed in the performance of the test

a. Burst pressure is recorded as the pressure at which actual rupture of a hose occurs.
b. A hold test, when required, is a means of deter mining whether weakness will develop under a given pressure for a specified period of time.

Nondestructive Tests

Nondestructive tests are conducted on a full length of a hose or hose assembly and are for the purpose of eliminating hose with defects which cannot be seen by visual examination or in order to determine certain characteristics of the hose while it is under internal pressure

a. A proof pressure test is normally applied to hose for a specified period of time. On new hose, the proof pressure is usually 50% of the minimum specified burst except for woven jacket fire hose where the proof pressure is twice the service test pressure marked on the hose (67% of specified minimum burst). Hydrostatic tests performed on fire hose in service should be no higher than the service test pressure referred to above. The regulation of these pressures is extremely important so that no deteriorating stresses will be applied, thus weakening a normal hose.

b. With some type of hose, it is useful to know how a hose will act under pressure. All change in length tests, are made with original length measurements taken under a pressure of 10 psi (0.069 Mpa). The specified pressure, which is normally the proof pressure, is applied and immediate measurement of the characteristics desired are taken and recorded.

Percent length change (elongation or contraction) is the difference between the length at 10 psi (0.069 Mpa) and that at the proof pressure times 100 divided by the length at 10 psi (0.069 Mpa). elongation occurs if the length of the hose under the proof pressure is greater than at a pressure of 10 psi (0.069 Mpa). Contraction occurs if the length at the proof pressure is less than at 10 psi (0.069 Mpa).

c. Percent change in outside diameter or circumference is the difference between the outside diameter or circumference at 10 psi (0.069 Mpa) and that obtained under the proof pressure times 100 divided by the outside diameter or circumference at 10 psi (0.069 Mpa). Expansion occurs if the measurement at the proof pressure is greater than at 10 psi (0.069 Mpa). Contraction occurs if the measurement at the proof pressure is less than at 10 psi (0.069 Mpa).

d. Twist is a rotation of the free end of the hose while under pressure. A first reading is taken at 10 psi (0.069 Mpa) and a second reading at proof pressure. The difference, in degrees between the 10 psi (0.069 Mpa) base and that at the proof pressure is the twist. Twist is reported as right twist (to tighten couplings) or left twist. Standing at the pressure inlet and looking toward the free end of a hose, a clockwise turning is right twist and counterclockwise is left twist.

Design Considerations
In designing hose it is customary to develop a design ration, which is a ratio between the minimum burst and the maximum working pressure.

Burst test data is compiled and the minimum value is established by accepted statistical techniques. This is done as a check on theoretical calculations, based on the strength of reinforcing materials and on the characteristics of the method of fabrication.

Minimum burst values are used as one factor in the establishment of a reasonable and safe maximum work pressure

MAXIMUM WORKING PRESSURE IS ONE OF THE ESSENTIAL OPERATING CHARACTERISTICS THAT A HOSE USER MUST KNOW AND RESPECT TO ASSURE SATISFACTORY SERVICE AND OPTIMUM LIFE.

It should be noted that design ratios are dependent on more than the minimum burst. The hose technologist must anticipate natural decay in strength of reinforcing materials, and the accelerated decay induced by the anticipated environments in which the hose will be used and the dynamic situations that a hose might likely encounter in service.

Including all considerations, the following recommended design ratios are given for newly manufactured hose:
1. Water Hose up to 150 psi WP: 3:1
2. Hose for all other liquids, solid materials suspended in liquids or air, and water hose over 150 psi WP: 4:1
3. Hose for compressed air and other gases: 4:1
4. Hose for liquid medial that immediately changes into gas under standard atmospheric conditionsl: 5:1
5. Steam Hose: 10:1.

METHOD FOR MEASURING ELECTRICAL RESISTANCE OF HOSE

Conduct test on non-conducting surfaces, and at normal room temperature and humidity.

Test Procedure
Conduct test as follows:
1. Cut sample hose to 24 inches long
2. Assure that both inside and outside of hose are free of oil, dirt, etc.
3. Pierce sample ends with clean nails.
4. Connect nails to 1000 volt DC power source and megohm meter or 1000 volt “megger”.
5. Record total resistance in megohms
6. Measure test length.
7. Divide total resistance by test length to get megohms per inch.