Garlock Sealing Technologies
Garlock Inc
1666 Division Street
Palmyra, New York 14522-9350
315/597-4811
Fax 315/597-5556
www.garlock-inc.com

Interoffice

To: Distribution
Re: M & Y values for flange design

From: Applications Engineering
Date: January 19, 2000

"What Are M & Y Values?"

We are frequently asked to provide M & Y values for our gaskets so that the customer can design flanged joints using the ASME Boiler and Pressure Vessel Code. Occasionally, we are asked to explain how these values are used and how they are determined for our gaskets.

In simple terms, a flange must be designed to create sufficient compressive load (usually expressed in stress, as psi) on the gasket contact area to create an initial seal. The gasket must conform to the flange surface (serrations when present) and must be compressed enough to seal off any internal voids or spaces. This stress is basically the "Y" value.

The "M" value allows the flange designer to determine the compressive load on the gasket required to maintain a seal when the vessel is pressurized. The flange must have sufficient strength and bolting to hold the joint together against the hydrostatic end force, and to apply some additional "net stress" on the gasket.

The "M" value is used as a multiplier or maintenance factor. The design will be such that the flange and bolting will hold the flanges together under pressure (the hydrostatic end force) and exert an additional stress on the gasket of "M" multiplied by the internal pressure.

The designer calculates the load required to seat the gasket (related to "Y") and performs a second calculation using the "M" value and the design internal pressure. The flanges are then built based on the larger of the two calculated values.

"How Does Garlock Sealing Technologies Determine M & Y Values?"

Garlock used the ASTM F586 method as a guide to test these values.

"M" - Maintenance Factor

The “M” factor that provides the additional preload needed in the flange fasteners to maintain the compressive load on the gasket after internal pressure is applied to a joint. We are basically calculating the "net stress" on the gasket after we compensate for the end-force pushing the joint apart. Once we find the "net stress" on the gasket to create a tight seal, we divide the "net stress" by the internal pressure to create the dimensionless "M" value as follows:

$$\text{“M” Factor} = (W - F_{hyd}) \div A_g \div P$$

Internal Pressure (psi)

Gasket Contact Area (in^2)

Hydrostatic End Force (lbs.)

Bolt Load (lbs.)

"Y" - Minimum Design Seating Stress

The "Y" factor is the minimum compressive stress in pounds per square inch (psi) on the contact area of the gasket necessary to provide a seal at an internal pressure of 2 psig. This value is not meant to be a seating stress value for actual service. The value is calculated by using the following equation:

$$\text{“Y” Factor} = W \div A_g$$

Gasket Contact Area (in^2)

Bolt Load (psi)

The "Y" value can be thought of as a minimum stress required to compress the voids of the gasket, and conform the gasket to the flange surface.

Garlock Leakage Levels for M & Y Values

"M" value is based on a leak rate of ≤0.5 cc/min. measured over a two-hour period.

- Mass Flow Rate = ≤1.00 x 10^{-2} mg/sec.
- Mass Flow Rate / Unit Diameter = ≤6.6 x 10^{-5} mg/sec-mm

"Y" value is based on a leak rate of ≤0.005 cc/min. or ≤5.0 x 10^{-3} cc/min. over a two-hour period.

- Mass Flow Rate = ≤1.0 x 10^{-4} mg/sec.
- Mass Flow Rate / Unit Diameter = ≤6.6 x 10^{-7} mg/sec-mm

All flow rates are for nitrogen gas (N2) at 60ºF and atmospheric pressure.

Mass flow rate/unit diameter is based on the use of a 4"-600# ring gasket with an outside diameter of 6-3/16" or 157.2 mm.

Eventually, the New Tightness Rules and Gasket Constants (**G_b**, **a**, & **G_s**) will replace M & Y values and calculations.

PVRC* Tightness Classification	Mass Leak Rate Per Unit Diameter (L_{rm}) (mg/sec-mm)
T1	2×10^{-1}
T2	2×10^{-2}
T3	2×10^{-3}
T4	2×10^{-4}
T5	2×10^{-5}

* NOTE: There are discussions of reducing the number of tightness classes to three (3).