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Technical Bulletin

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EN 13555

Flanges and their joints – Gasket parameters and test procedures relevant to the design rules for gasketed circular flange connections

EN 13555 shows characteristics of a gasket's ability to seal and maintain a seal when exposed to a standardized regimen of compressive loads, temperatures and pressures. This European standard specifically exists to provide,

> "…the test procedures to allow the generation of the gasket parameters to enable the design equations established in EN 1591-1 to be employed. The same test procedures may be used for "Type Testing" of gaskets and gasket materials. These are not for routine quality control purposes."
> Reference EN 13555-2014 (E), page 5 – Introduction

EN 15191-1, "Flanges and their joints - Design rules for gasketed circular flange connections - Part 1: Calculation," uses the results of EN 13555 to calculate the required minimum and maximum bolt torque to develop the compressive load needed to attain required leak tightness and ensure that flanges and bolts are adequate to attain the required leak tightness. EN-1591-1 considers the gasket, flanges, bolts and the allowed leakage as a system in which all these parts must work within their capabilities.

When looking at GYLON EPIX EN 13555 data consider the following definitions to see the relevance to gasket performance:

		Test Method	units	GYLON® EPIX Style 3504 EPX
Maximum Tolerated Assembly Stress (Qsmax) In accordance to DIN EN 13555	68°F (20°C)	EN 13555	psi (MPa)	29,000 (200)
	212°F (100°C)	EN 13555	psi (MPa)	17,400 (120)
	302°F (150°C)	EN 13555	psi (MPa)	14,500 (100)
	392°F (200°C)	EN 13555	psi (MPa)	11,600 (80)
	482°F (250°C)	EN 13555	psi (MPa)	8,700 (60)

Qsmax – The maximum compressive stress that can be imposed on the gasket while at service temperature without collapsing. The table gives values at temperatures ranging from 68F (20C) to 482F (250C).

Significance: The higher the value the higher the material's ultimate compressive stress limit. Knowing this will determine the maximum allowed bolt torque to assure that the gasket is not mechanically compromised. It will also alert the user to flange and bolting designs that are capable of delivering compressive loads to the gasket that can damage it causing it to leak.

Minimum Stress (Qmin) needed to reach 0.01 [mg/(s*m)]	150-600 psig (10-40 bar)	EN 13555	psi (MPa)	725 (5)
	1,160 psig (80 bar)	EN 13555	psi (MPa)	1,450 (10)

Qmin (L) or Qmin (0.01) – This is the minimum compressive stress required by the gasket at assembly to attain a leak level of 0.01 mg/(sec.*m). Qmin = compressive stress applied at assembly (QA) minus the stress lost due to hydraulic end force when the flange assembly in pressurized. The units express the rate of helium gas in milligrams escaping from the flange every second for each meter of the mean diameter of the gasket. The data table gives Qmin for the listed internal pressures. It is at these compressive stresses that the leak rate was < or = to 0.01 mg/sec.-m.

Significance: Lower Qmin shows it is easier for the gasket to attain an initial seal. Difficulty attaining a seal increases with increasing Qmin. A gasket with a high Qmin would require a flange and bolting system able to deliver the required compressive stress to the gasket.

Maximum Sealability Class at 68°F (20°C) at 2,900 psi (20 MPa) Assembly stress	145-290 psig (10-20 bar)	EN 13555	L[mg/(s*m)]	1.0×10^{-4}
	580-1,160 psig (40-80 bar)	EN 13555	L[mg/(s*m)]	1.0×10^{-3}
Maximum Sealability Class at 68°F (20°C) at 23,200 psi (160 Mpa) assembly stress	580 psig (40 bar)	EN 13555	L[mg/(s*m)]	1.0×10^{-5}

Maximum sealability class – The pressure ranges and temperature in the table shows the gasket material's tightness level expressed in the helium leak rate at the compressive stress stresses of 2900 psi (20 MPa) which is a relatively low compressive stress and 23,200 psi (160 MPa) which reflects Qsmax, the maximum compressive stress.

Significance: The lower the leak rate the better the material seals. Comparing leak rate to compressive stress gives one a sense for how much compressive load (that is, bolt load as developed by the bolt torque) is required to get the best seal the material capable of delivering.

Initial & Residual Assembly Stress required to achieve sealability of 0.01 [mg/(s*m)] (In accordance with DIN EN 13555 test method)		
Corresponding Pressure	Initial Assembly Stress (QA)	Residual Assembly Stress
150 psig (10 bar)	1,450 psi (10 Mpa)	435 psi (3 MPa)
300 psig (20 bar)	1,450 psi (10 Mpa)	580 psi (4 MPa)
600 psig (40 bar)	1,450 psi (10 Mpa)	725 psi (5 MPa)
1,160 psig (80 bar)	2,900 psi (20 Mpa)	1,450 psi (10 MPa)

The gasket is loaded at assembly to the initial compressive stress QA, pressurized with helium and unloaded until the leak level reaches 0.01 mg/sec*m at the residual assembly stress.

Significance: Shows gasket material's ability to be unloaded and still maintain a seal. The lower the residual assembly stress the better the material's capability to keep seal due to unloading. Flange joints can become unloaded due to hydrostatic end force (produced by the internal system pressure), loss of bolt load due to creep, vibration, etc. The lower the residual stress is, the safer the joint will be.