The Influence of SWG on Low Emission Valve Performance

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Agenda

- Introduction
- Objective
- Gasket evaluation parameters
- Testing parameters
- Body/Bonnet design differences
- Results and discussions
- Conclusion

Introduction

- **According to API 624, API 641 and API 622 (Draft 3rd edition) the leakage shall not exceed 100 ppmV**
- **API-624: Leakage from body-bonnet connections shall be corrected prior to test execution.**

Objective

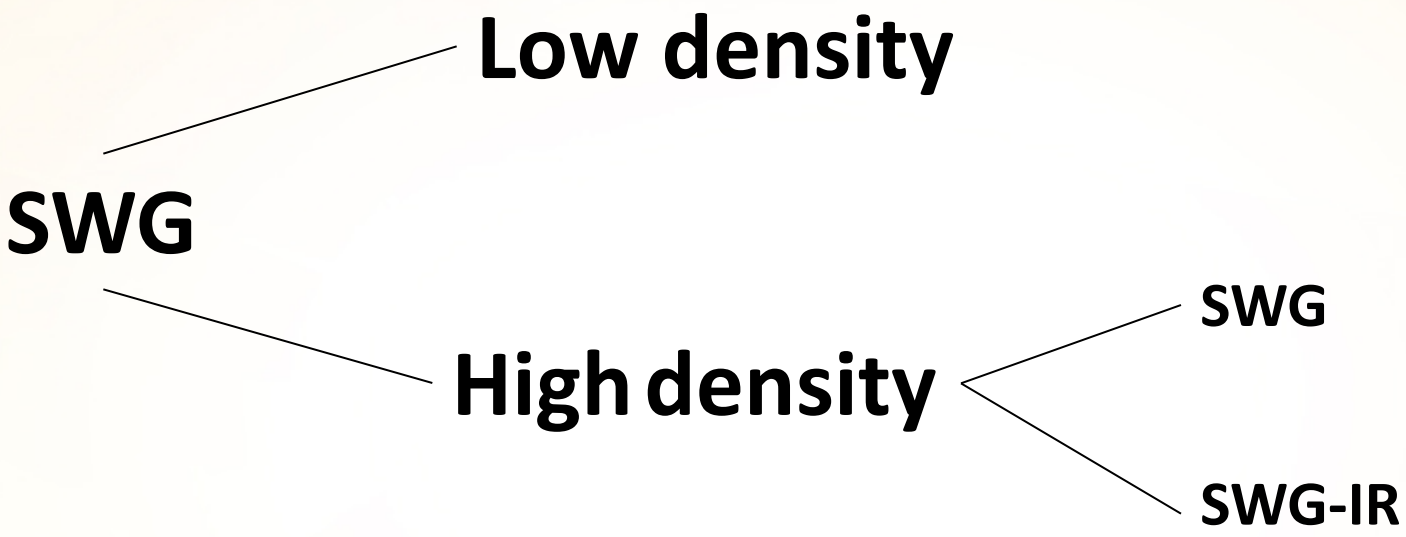
- **Optimize Spiral Wound Gasket design for valve bonnet low emission VOC applications**

Gasket Evaluation Parameters

SS304 with Flexible Graphite SWG:

- **Low or high density?**
- **Inner Ring? Yes / No**
- **Outer Ring? Yes / No**
- **Inward Buckling**

Gaskets Tested

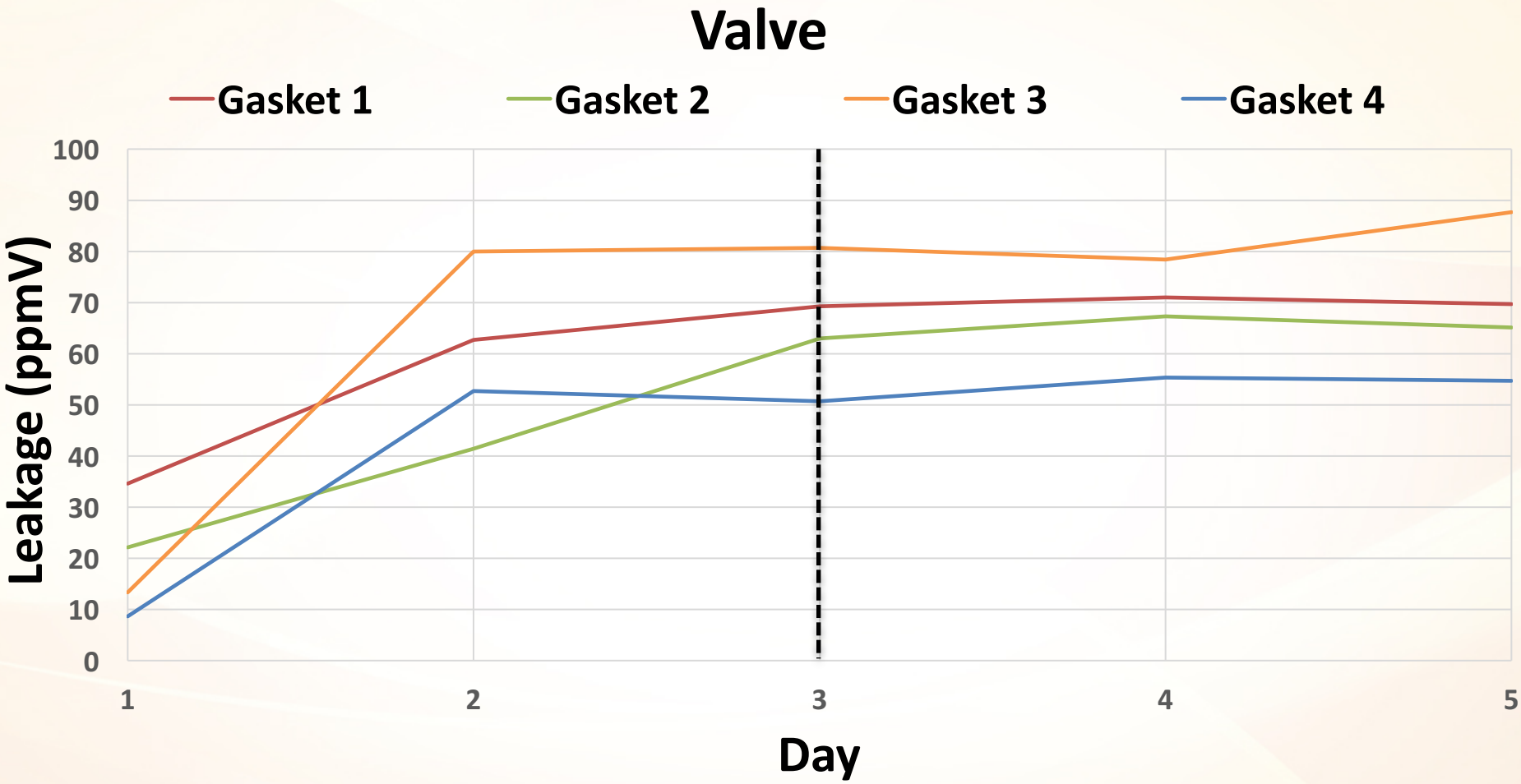


SWG Density: windings per inch

Testing Parameters

- Gasket Stress: 10 000 psi
- Room temperature
- Bolt lubrication: Moly Paste
- Test pressure: 40 bar
- Test Media: Methane
- Leak detection: EPA Method 21
- 3 Samples of each gasket
- 1 reading per day for 3 days

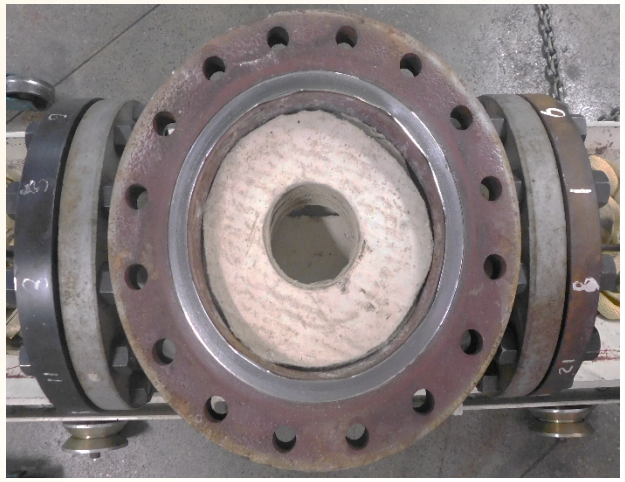
Reading Stabilization

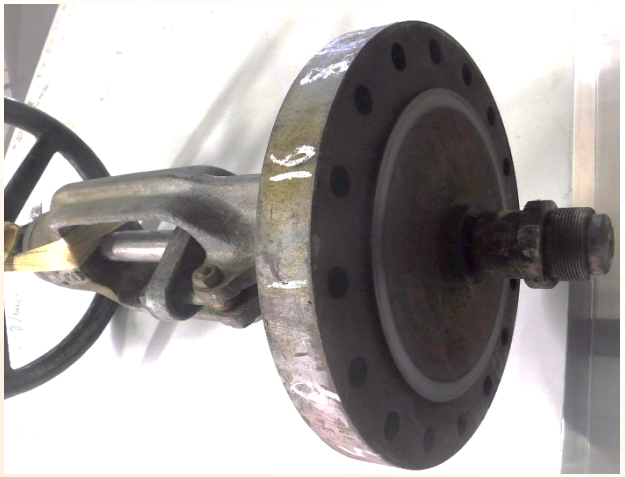


After 3 days, all gaskets were stabilized

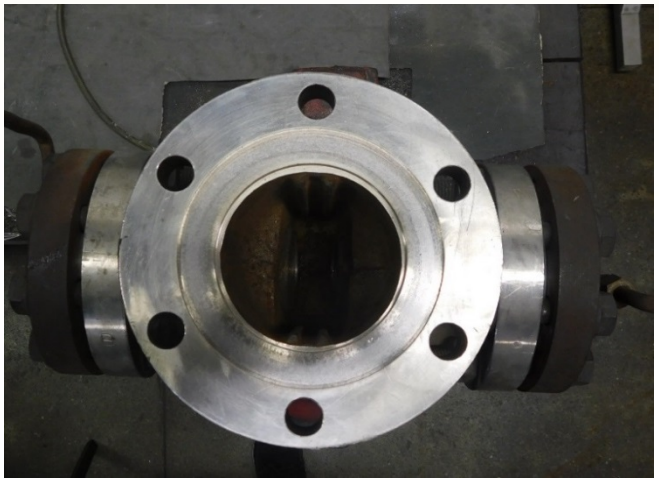
Body / Bonnet

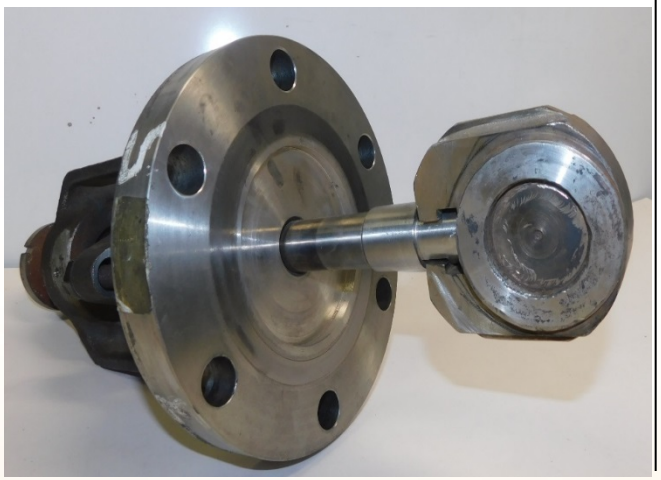
8”300#
Male and Female



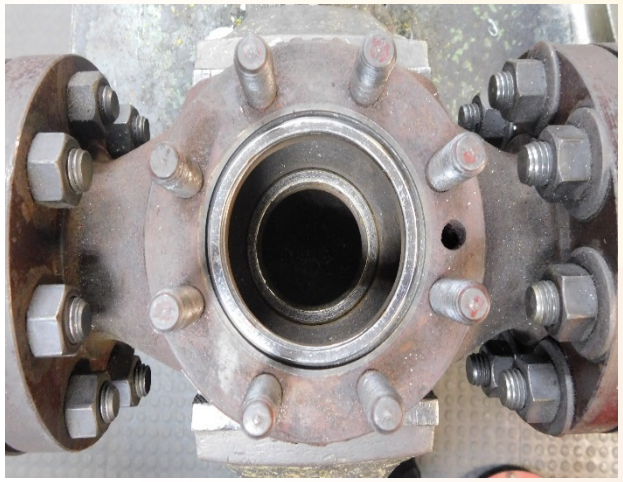


2”600#
Female and Flat Face

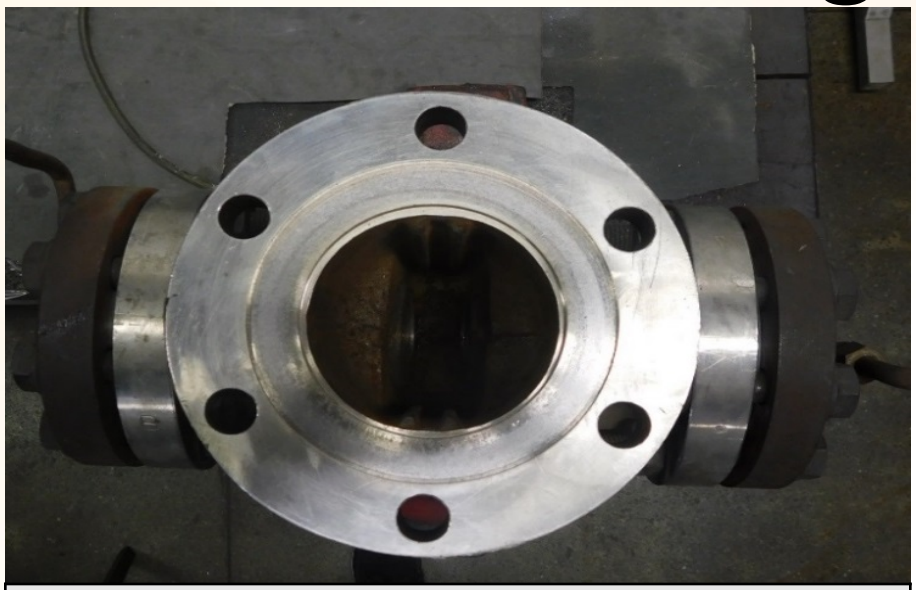




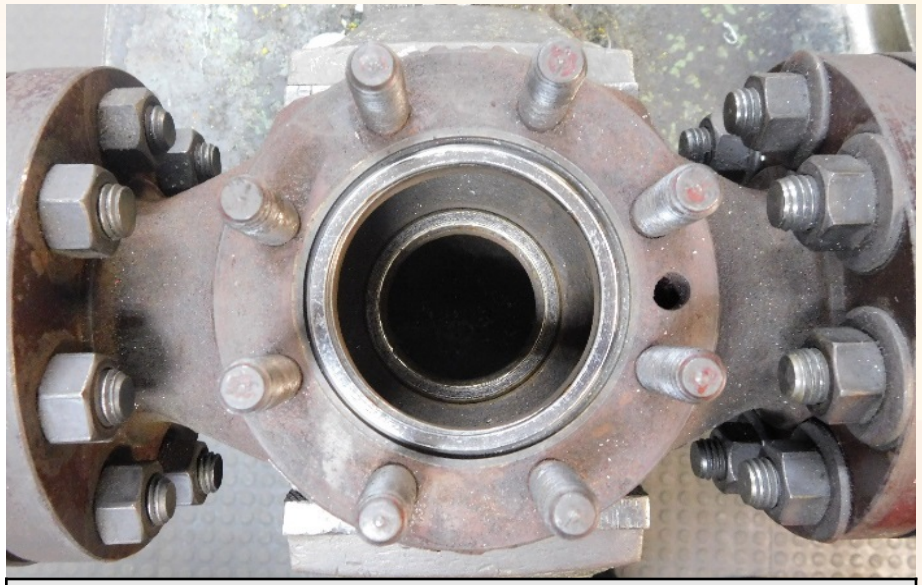
2”300#
Male and Female



Valve Design Differences



2"600#	
Nº of bolts	6
Bolt diam.	5/8"
Max gasket Stress	**23 000 psi**



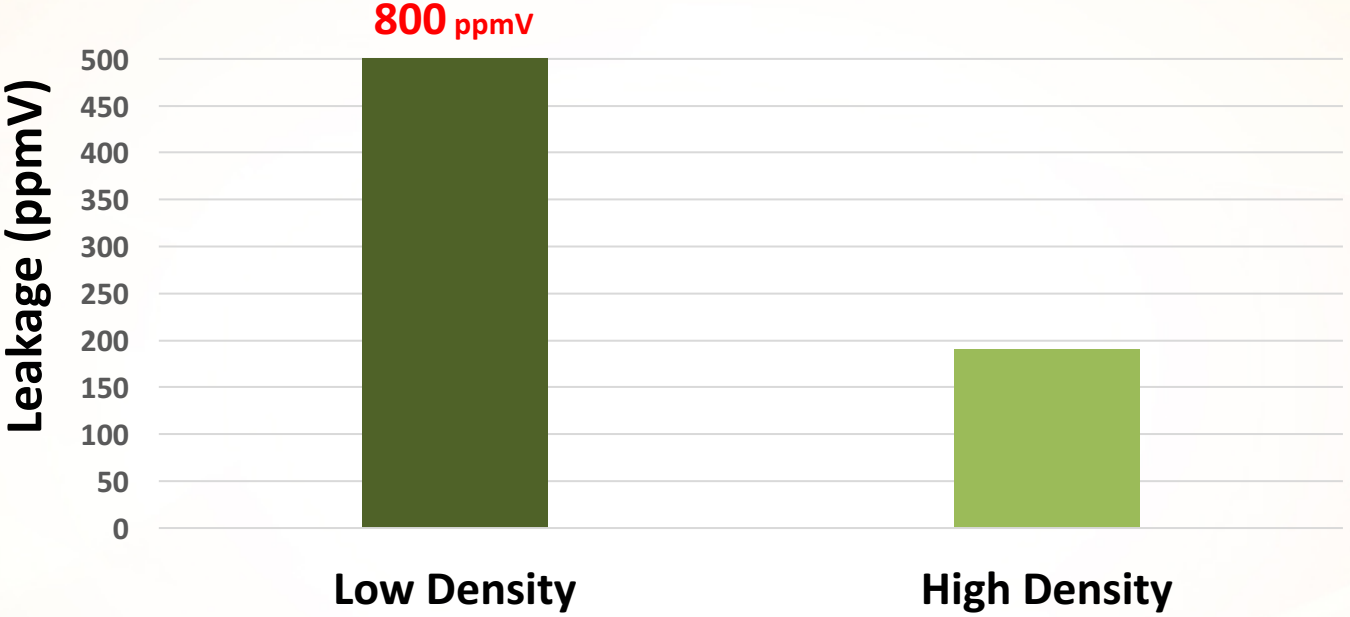
2"300#	
Nº of bolts	8
Bolt diam.	1/2"
Max gasket Stress	**47 000 psi**

75% of Bolt Yield

SWG Density

8”300#

Low x High Density



- Results confirm *PVP2011- 57556 “The influence of winding density in the sealing behavior of spiral wound gasket*.”
- Higher density gaskets have better sealability.
- All tests were performed with high density gaskets.

With x Without Inner Ring

8”300#

Inner Ring = better result

Inward Buckling

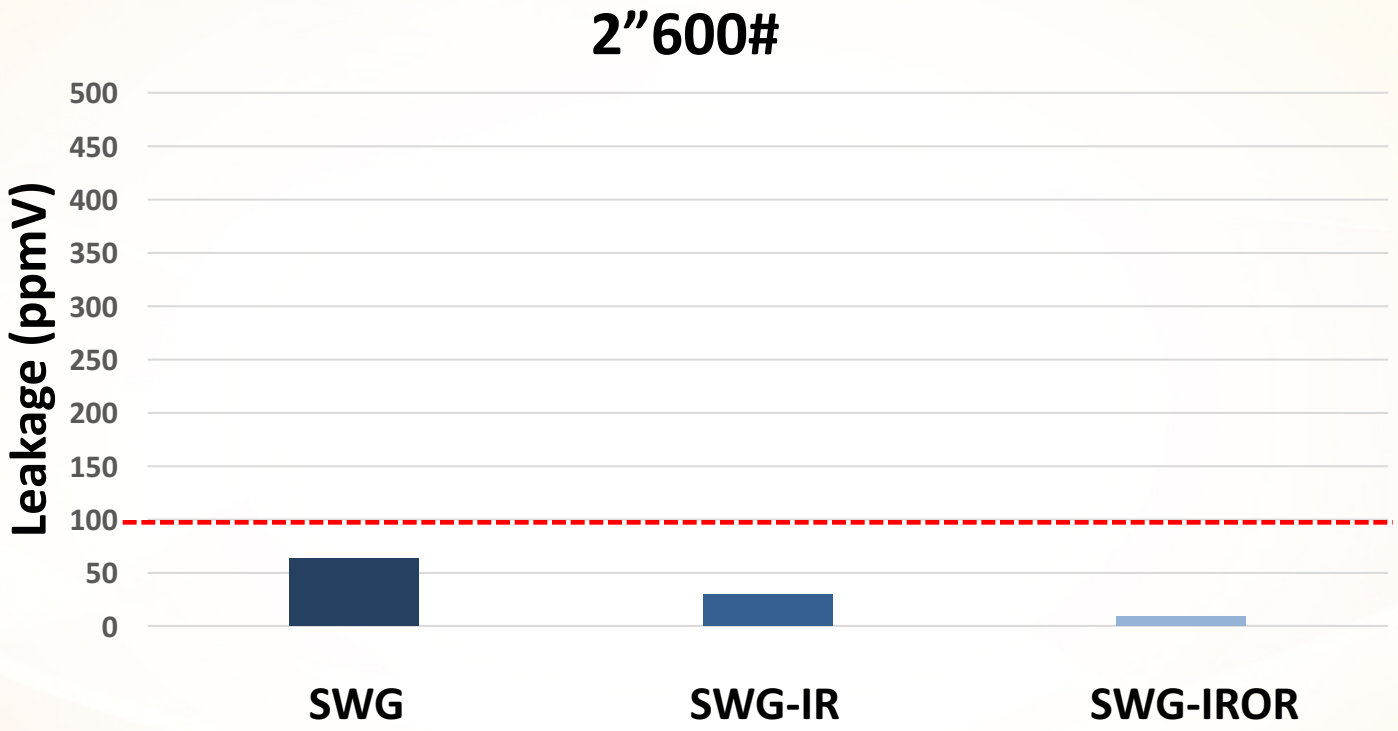
8”300#

<u>ASME B16.20:</u> 3.2.5 Inner Ring. *“Inward bucking of spiral-wound gaskets has been identified as a potential problem... Inner rings for flexible graphite-filled, spiral-wound gaskets shall be furnished unless the purchaser specifies otherwise.”*

SWG

SWG-IR

With x Without Inner Ring (x Outer ring)



Inner Ring = better result

Outer Ring = even better

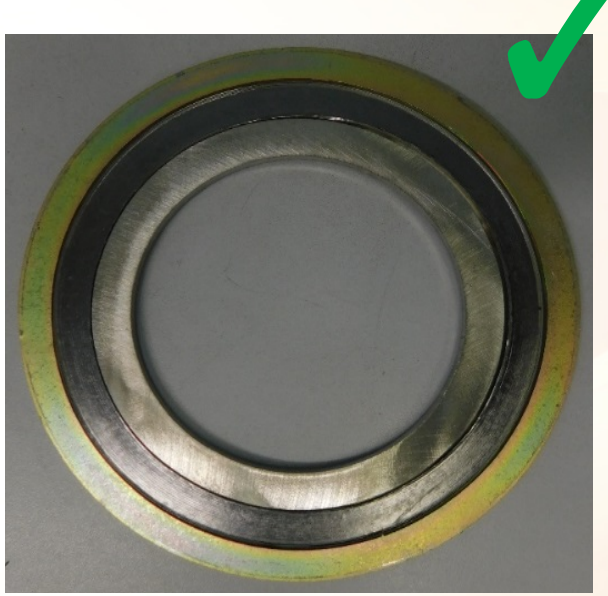
2”600#

SWG

Inward buckling

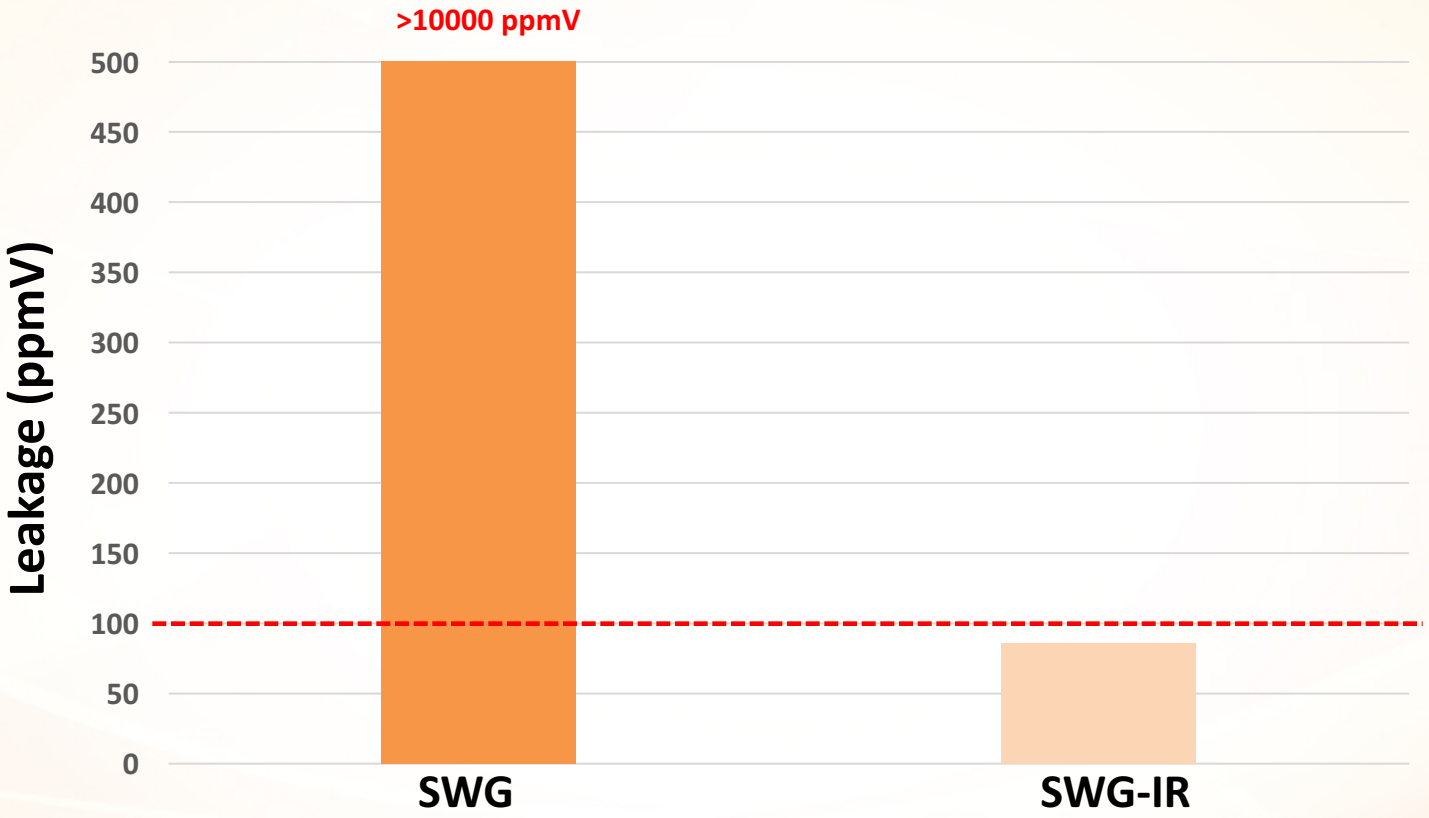
SWG-IR

SWG-IROR



With x Without Inner Ring

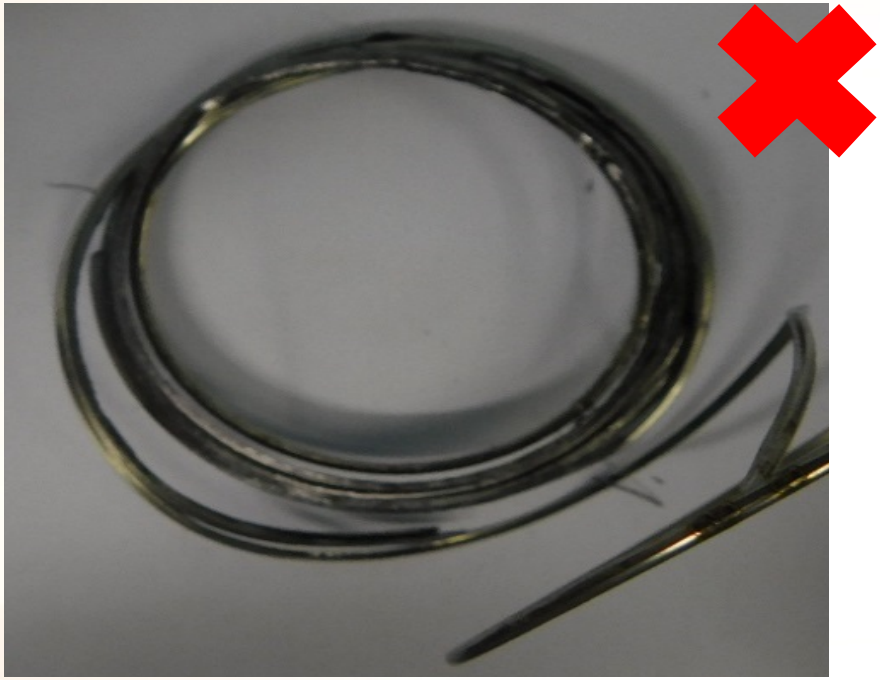
2”300#



A 1.5 mm width inner ring was engineered to fit the groove dimensions.

2”300#

SWG



Inward Buckling

SWG-IR

Conclusions

- Higher density windings improve sealability
- Inner Rings:
  - Improve gasket performance
  - Prevents inward buckling
- Properly engineered Spiral Wound Gaskets will assure API 624 emissions compliance.

Thank you!