



**VALVE MANUFACTURERS ASSOCIATION OF AMERICA**  
2014 Technical Seminar & Exhibition

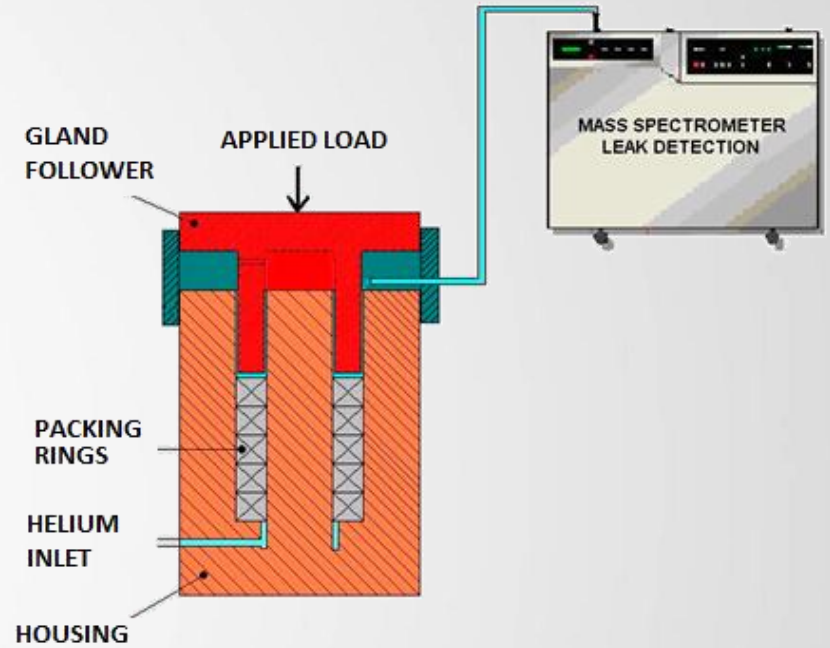
## **VALVE PACKING & GASKET RESEARCH AND DEVELOPMENT DEVICES**

**VALVE EMISSIONS COMPLIANCE, STANDARDS & TECHNOLOGY**  
Planet Hollywood, Las Vegas, NV  
March 6 – 7, 2014

**Jose Carlos Veiga, P.E.**

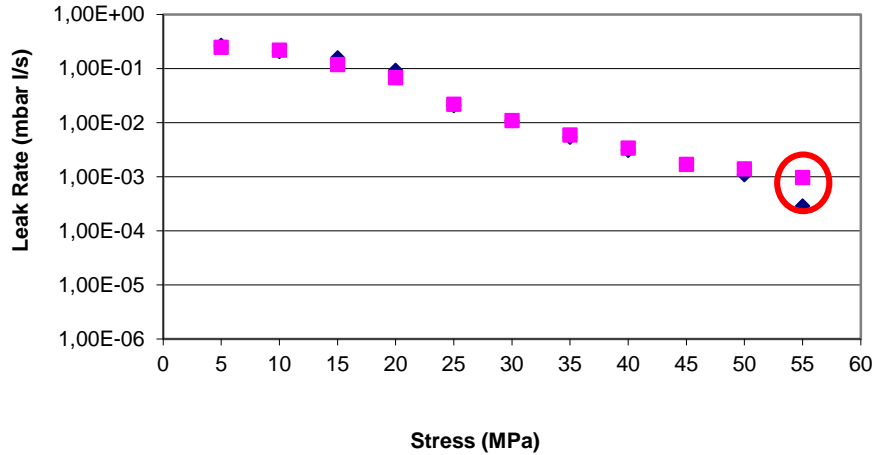
**Teadit Ltda.**  
**Rio de Janeiro, Brazil**

# Packing Minimum Seating Stress

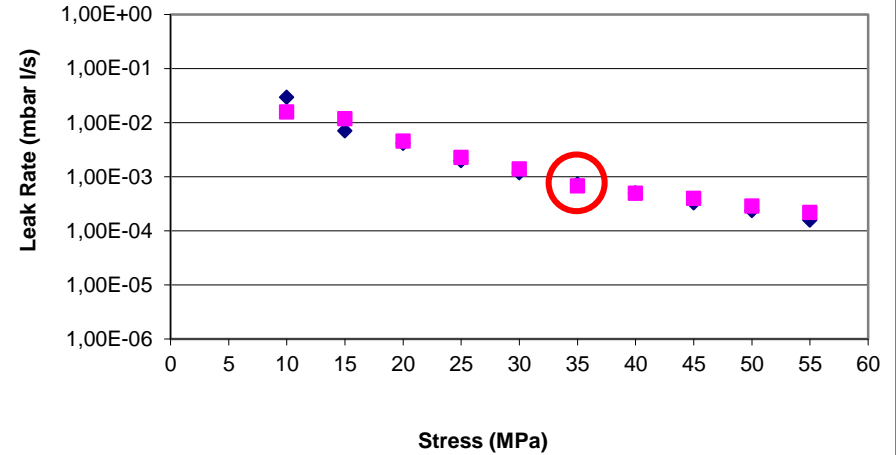


# Packing Minimum Seating Stress

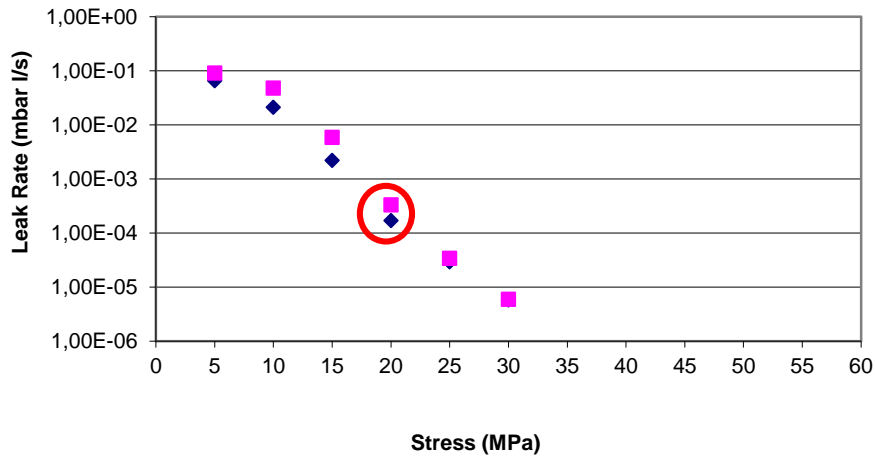
### Ni-Cr Wire Mesh Reinforced Yarn Flexible Graphite Packing (no impregnation)



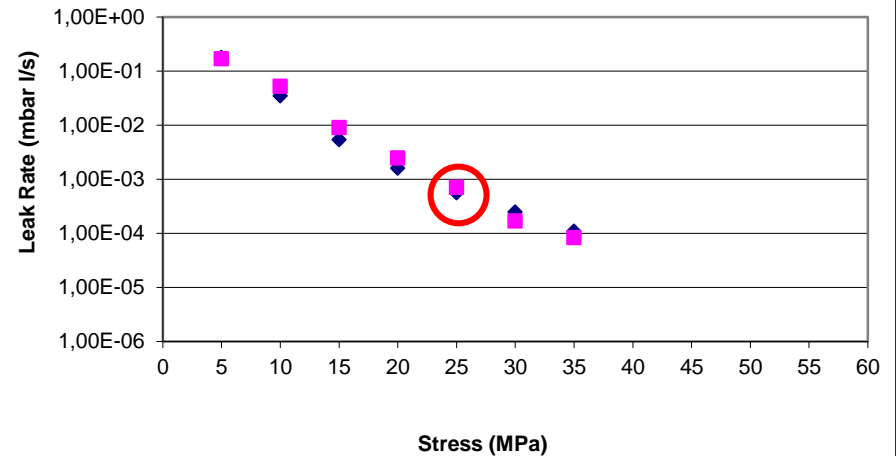
### Ni-Cr Wire Reinforcement Flexible Graphite Packing



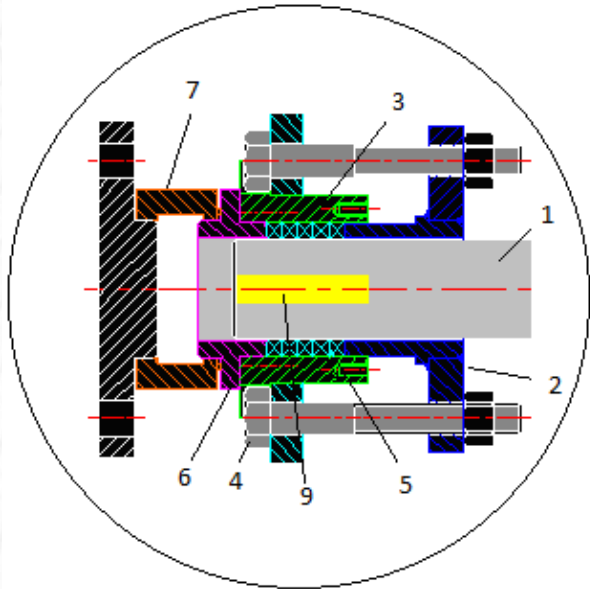
### Carbon and Flexible Graphite Packing with Graphite impregnation



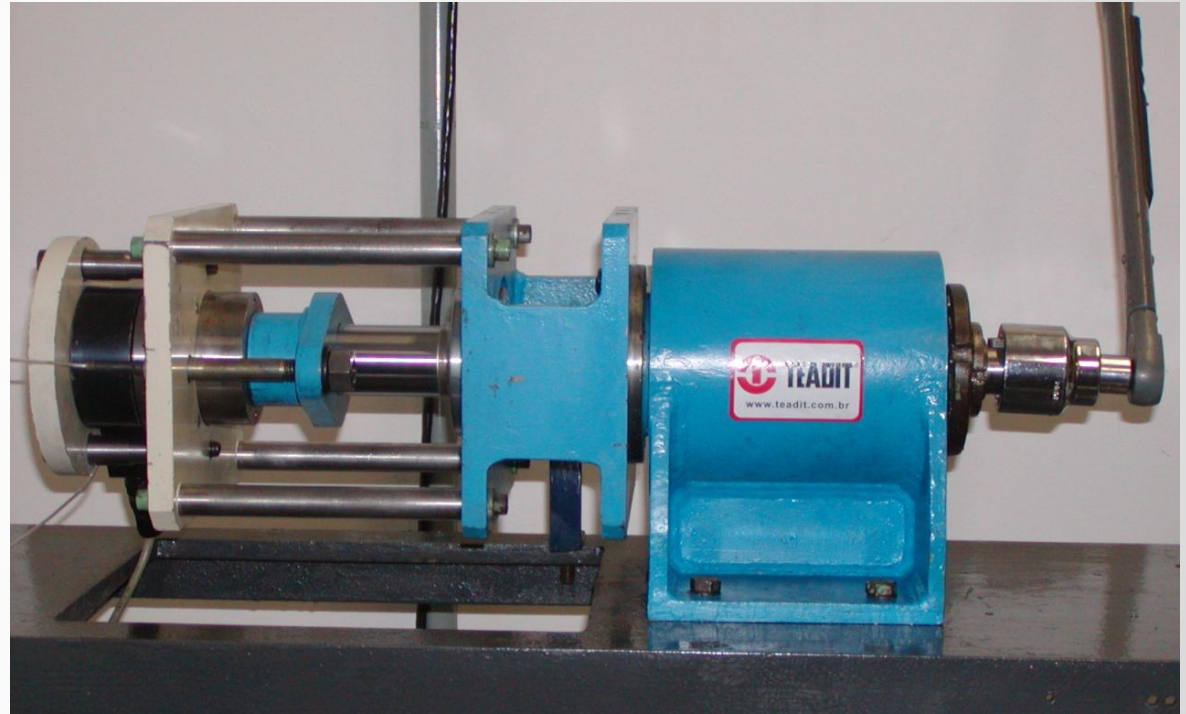
### Expanded PTFE filled with Barium Sulphate Packing



# Packing Drag, Force Transmission and Thermal Expansion Test Rig

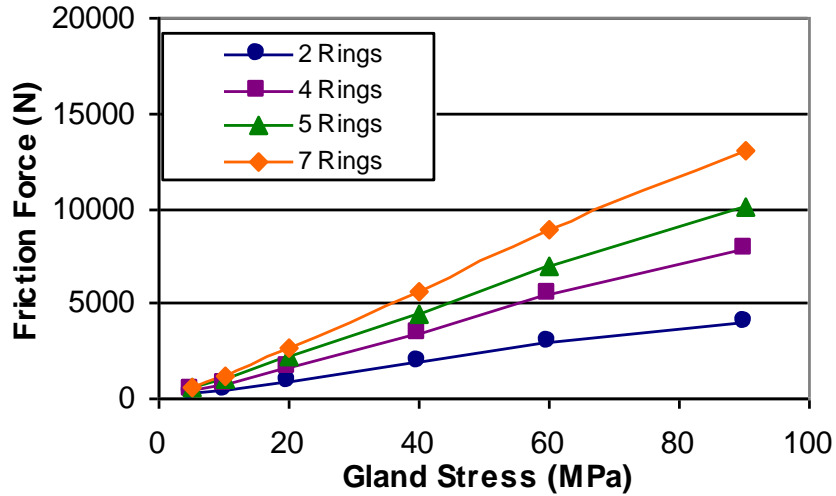


- 1 - Stem
- 2 - Gland
- 3 - Bonnet
- 4 - Internally Gaged Bolt
- 5 - Packing
- 6 - Bushing
- 7 - Load Cell
- 8 - Load Cell Base
- 9 - Electrical Resistance

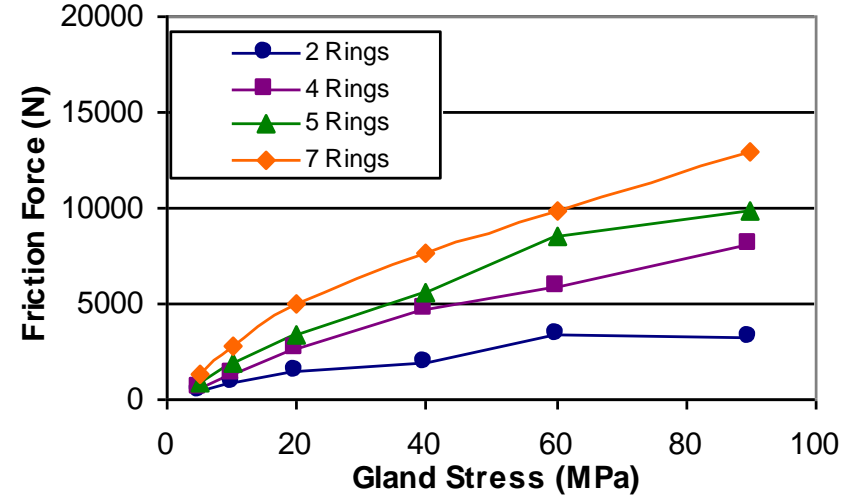


# Packing Drag

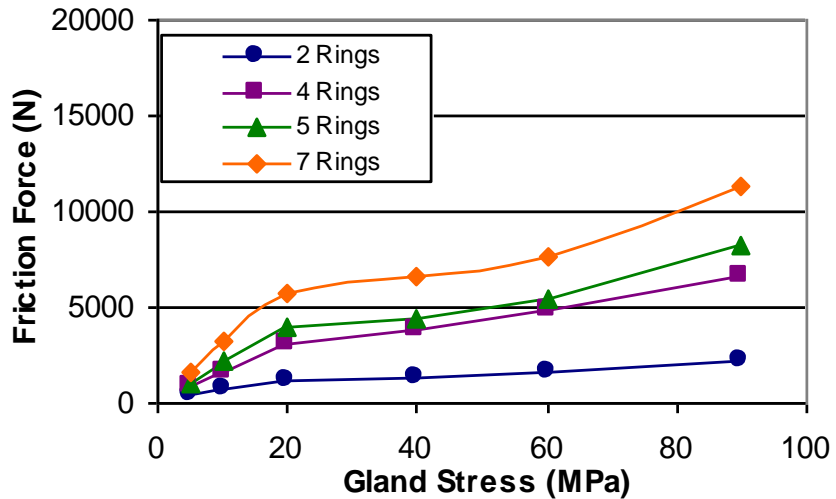
### Ni-Cr Wire Mesh Reinforced Yarn Flexible Graphite Packing (no impregnation)



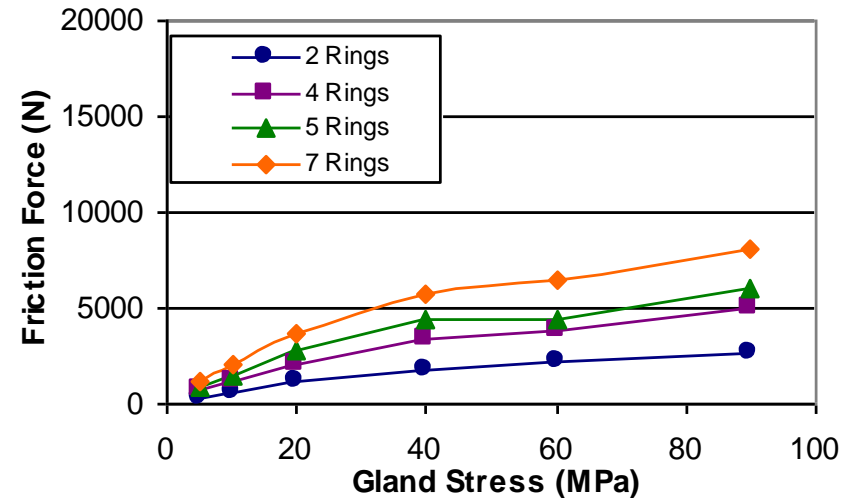
### Ni-Cr Wire Reinforcement Flexible Graphite Packing



### Carbon and Flexible Graphite Packing with Graphite impregnation

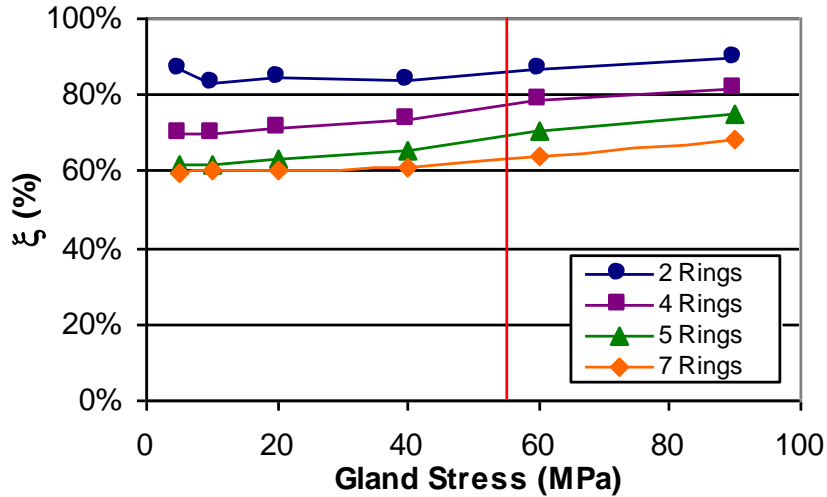


### Expanded PTFE filled with Barium Sulphate Packing

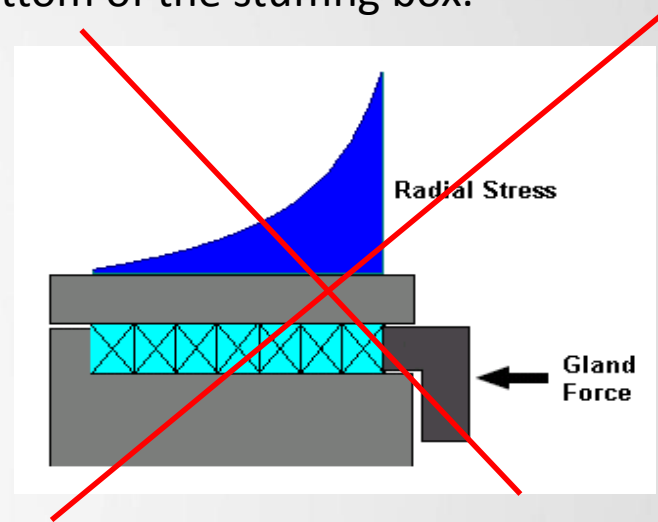


# Force Transmission

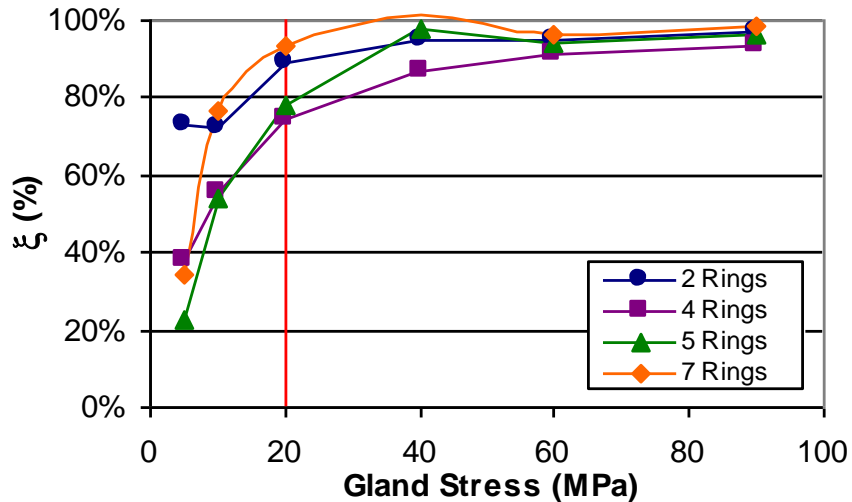
Ni-Cr Wire Mesh Reinforced Yarn Flexible Graphite Packing (no impregnation)



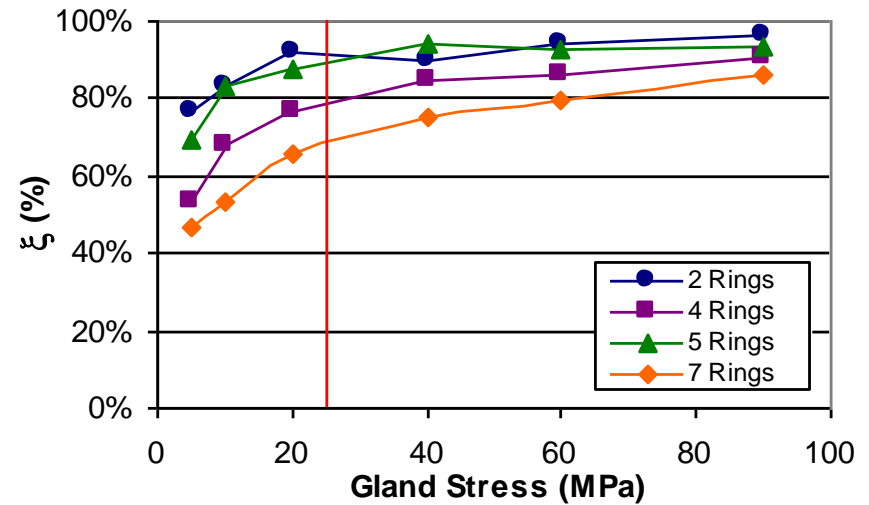
❖ Most of the applied stress reaches the bottom of the stuffing box.



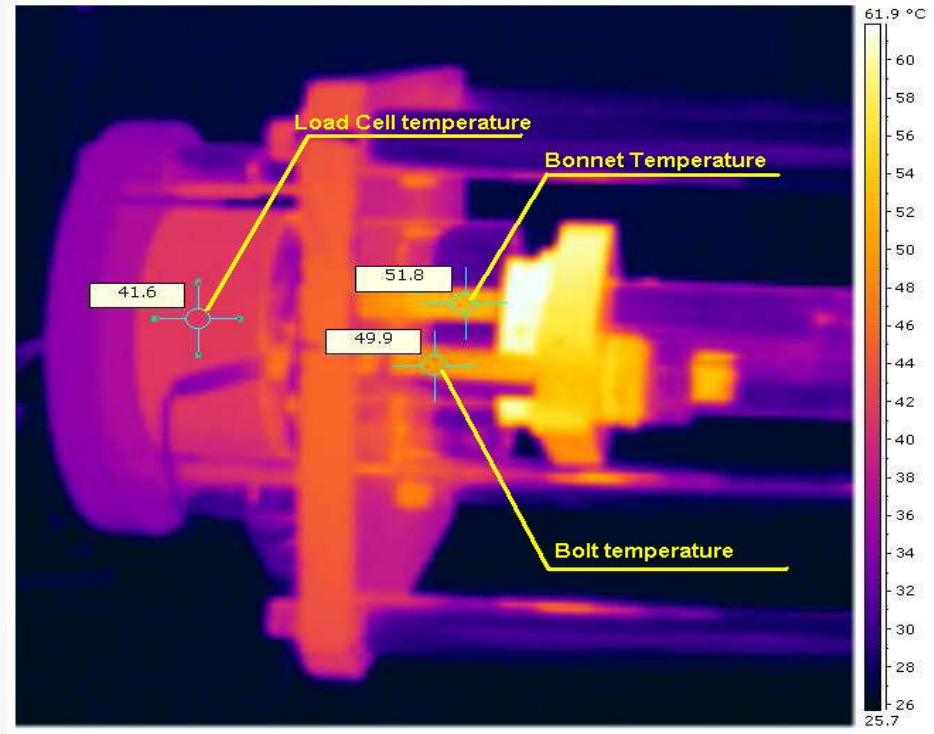
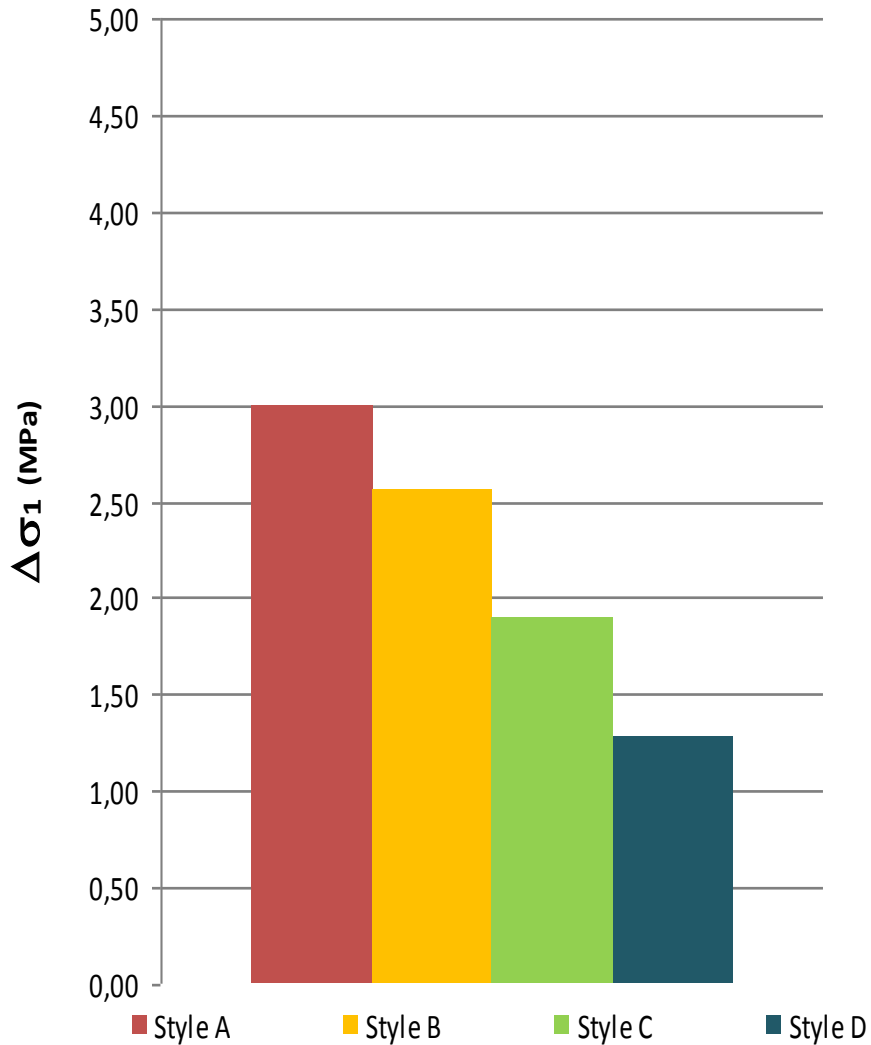
Carbon and Flexible Graphite Packing with Graphite impregnation



Expanded PTFE filled with Barium Sulphate Packing

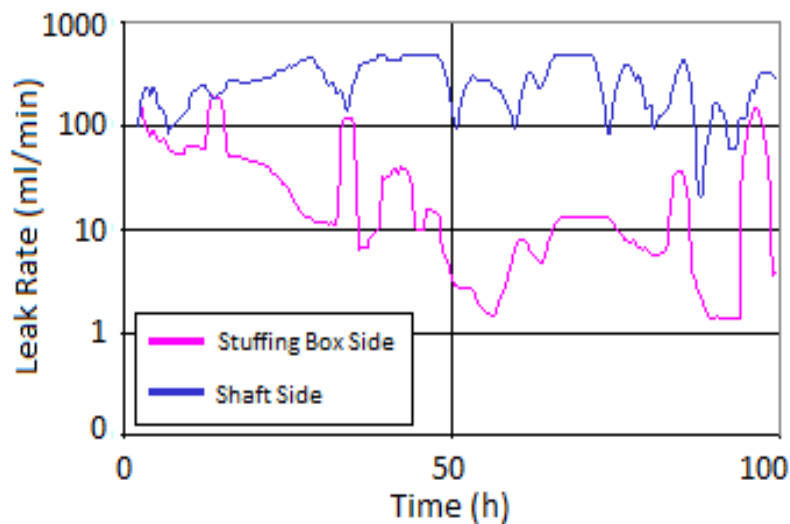
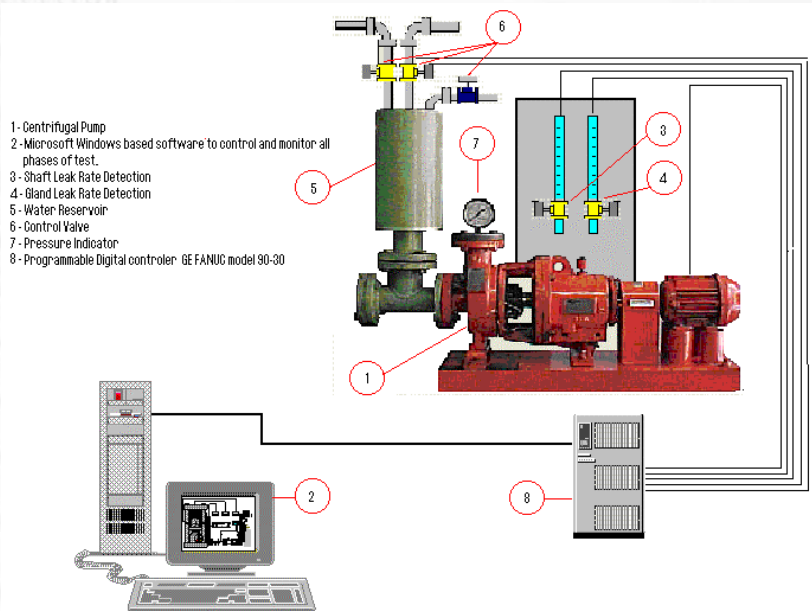


# Thermal Expansion Test Results (Amb. – 212F)



Style	Yarn	Filler	Comparative e-PTFE content
<i>A</i>	e-PTFE	None	100% e-PTFE
<i>B</i>	e-PTFE	Barium Sulphate	B% < A%
<i>C</i>	e-PTFE	Barium Sulphate	C % < A% & B%
<i>D</i>	e-PTFE	Graphite	D% < A%, B% & C%

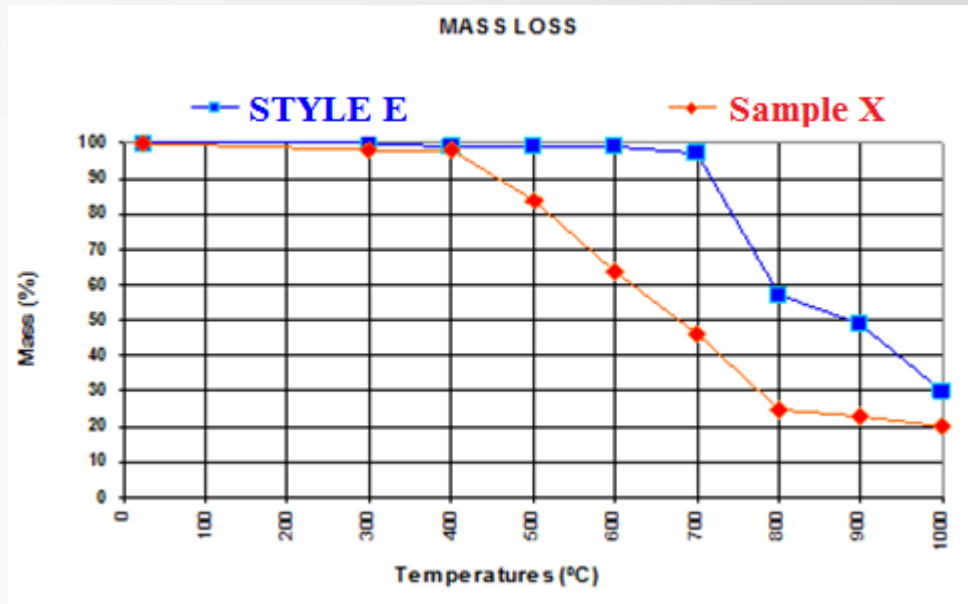
# Thermal Expansion Test Results (Amb. – 212F)



Style	Average Leakage
<b>A</b>	313 mL/min
<b>B</b>	107 mL/min
<b>C</b>	44 mL/min
<b>D</b>	3 mL/min



# Material Degradation and API 607 Simulation



Packing	External Leakage	<b>Validation</b> API 607 Test
	After burn and cool-down (5min)	
Style E	0.0 mL/min	CERTIFIED
Style F	0.0 mL/min	CERTIFIED
Style H	0.2 mL/min	CERTIFIED



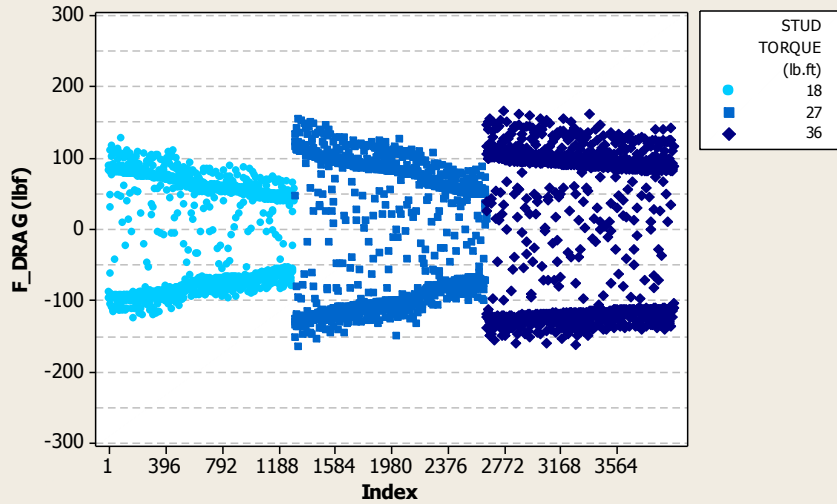
# Knife Valve Test

- Drag forces
- Sealability

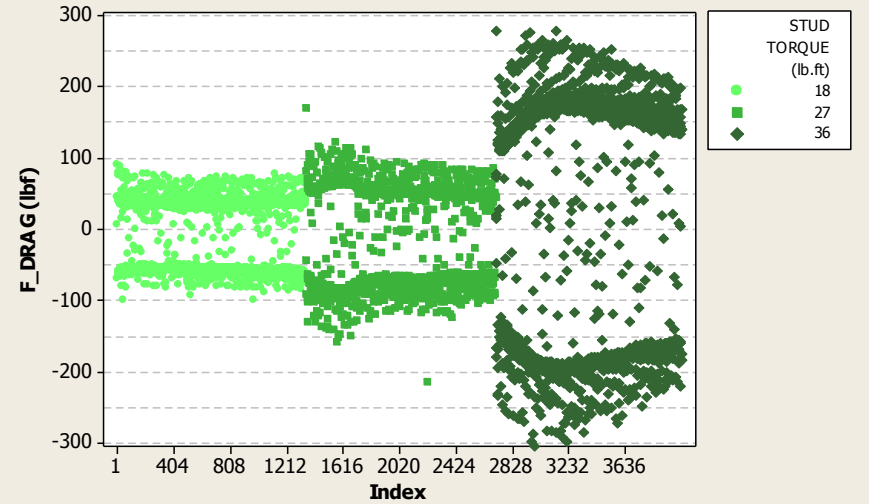


# Knife Valve Test Results

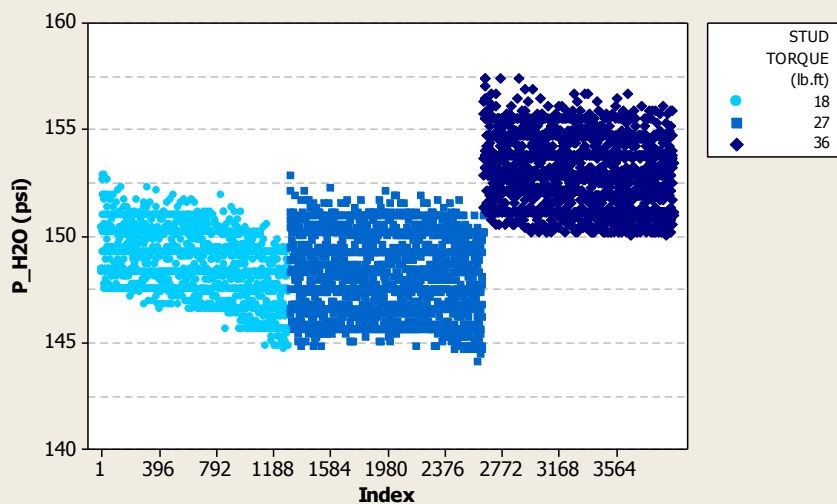
### F\_DRAG for STYLE C (ePTFE/Graphite)



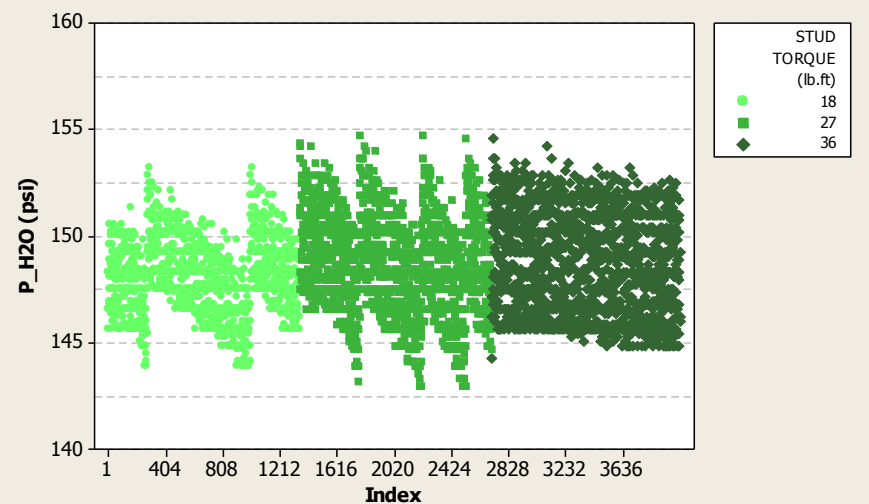
### F\_DRAG for STYLE A (Synthetic/PTFE)



### P\_H2O for STYLE C (ePTFE/Graphite)



### P\_H2O for STYLE A (Synthetic/PTFE)



# Gate Valve Tests

API 624 (draft)  
API 622 (simulation)  
Chevron Protocol  
ISO 15848-1  
VDI 2440

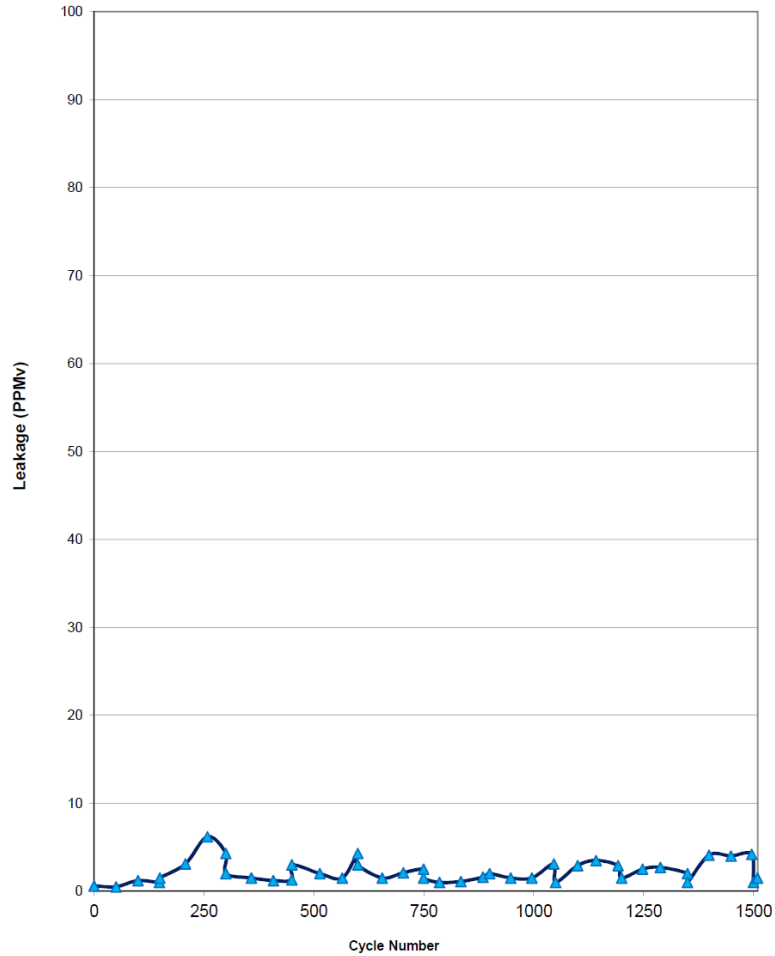


# Gate Valve Test Results

## Teadit Research and Development

API Standard 622 2nd Ed. Simulation (4" CL300) Test Report

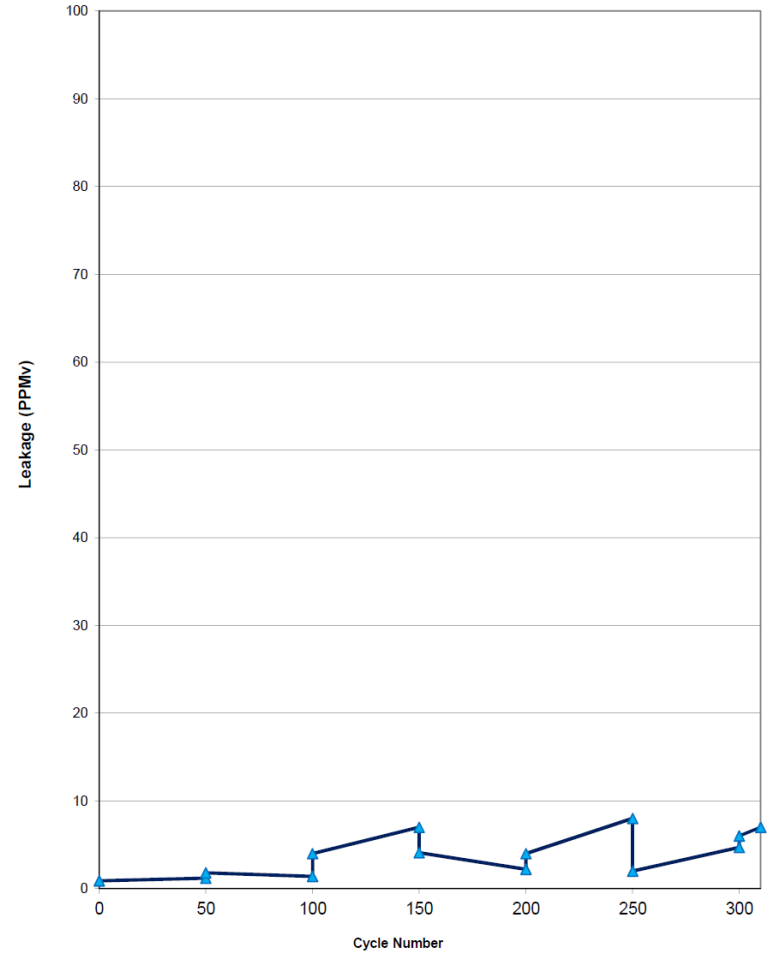
Static Leakage Chart  
Reading



## Teadit Research and Development

API Standard 624 1st Ed. (Draft Apr.2012) Test Report

Static Stem Leakage Chart  
Reading



# Control Valve Testing

## ISO 15848-1

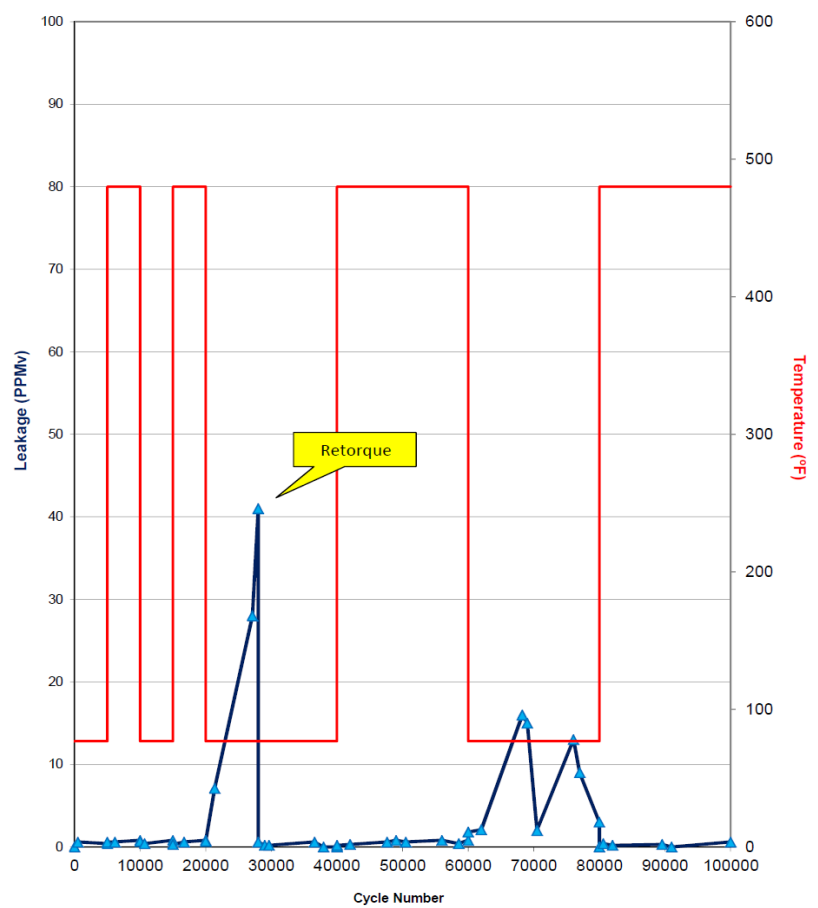
## Test Results



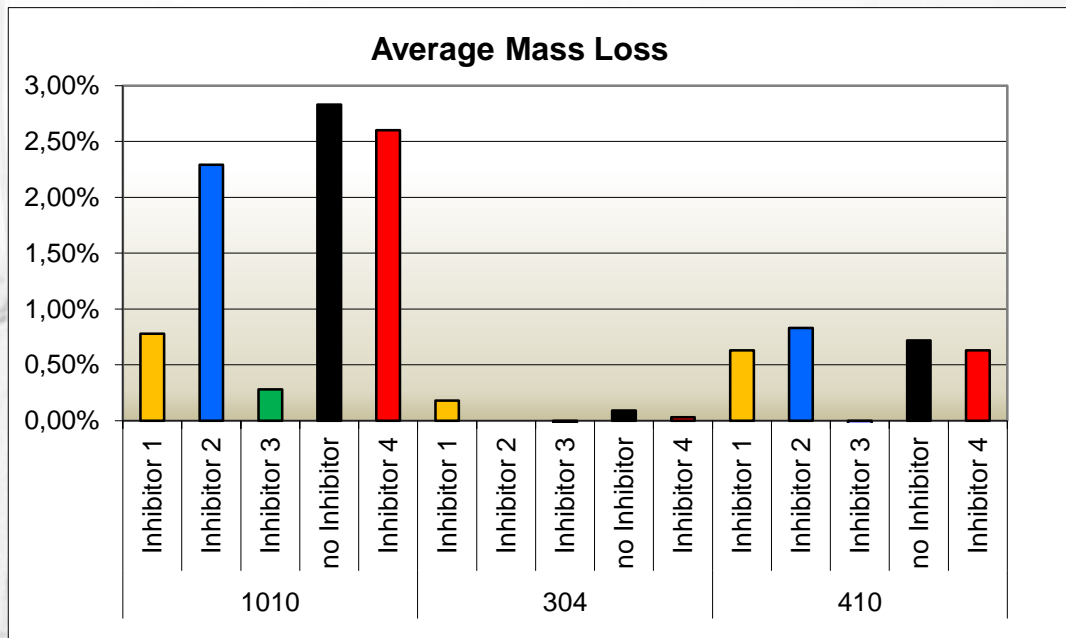
Teadit Research and Development

ISO 15848-1 (EPA Method 21) Test Report

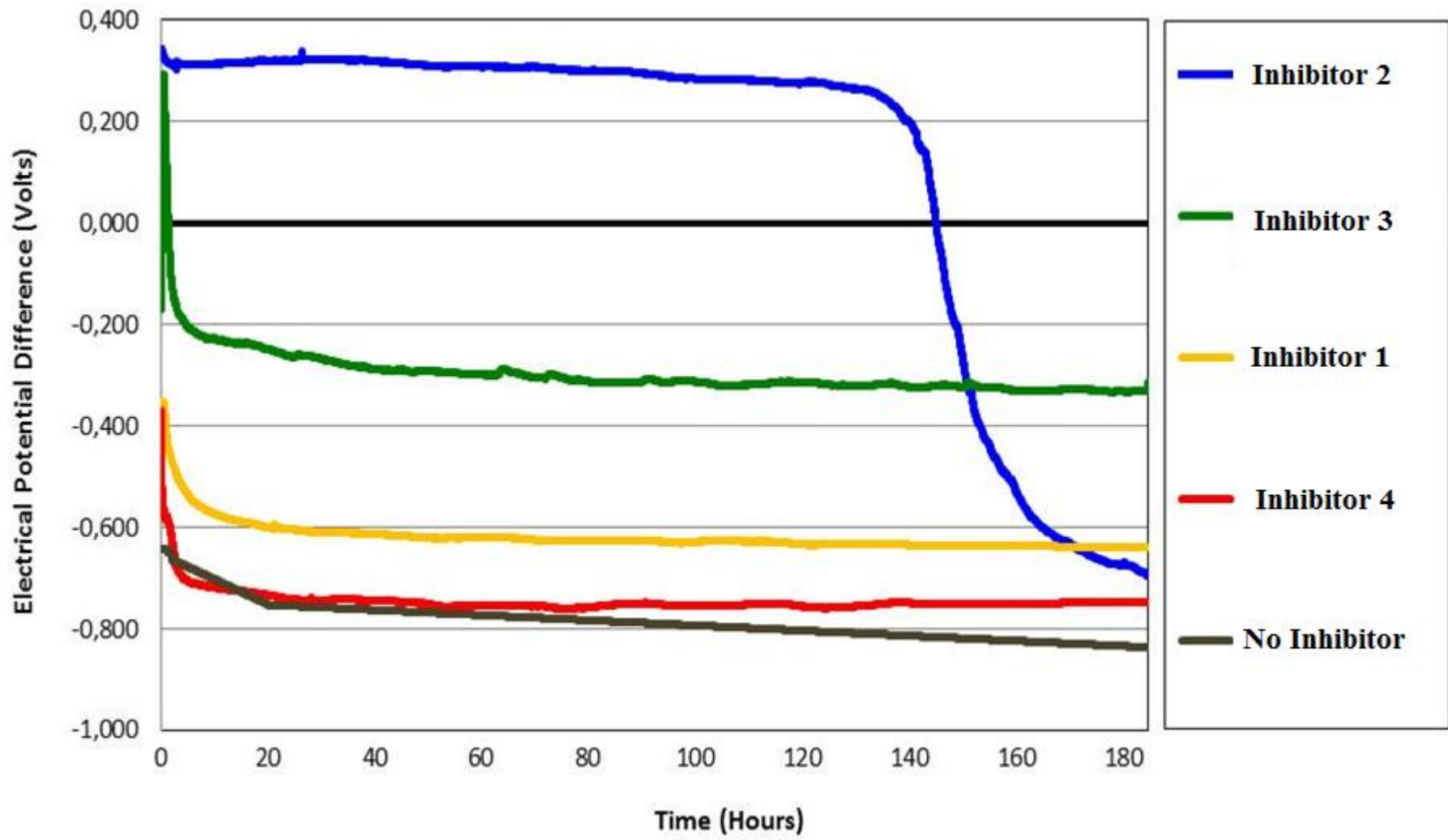
Static Stem Leakage Chart Reading



# CorroTest

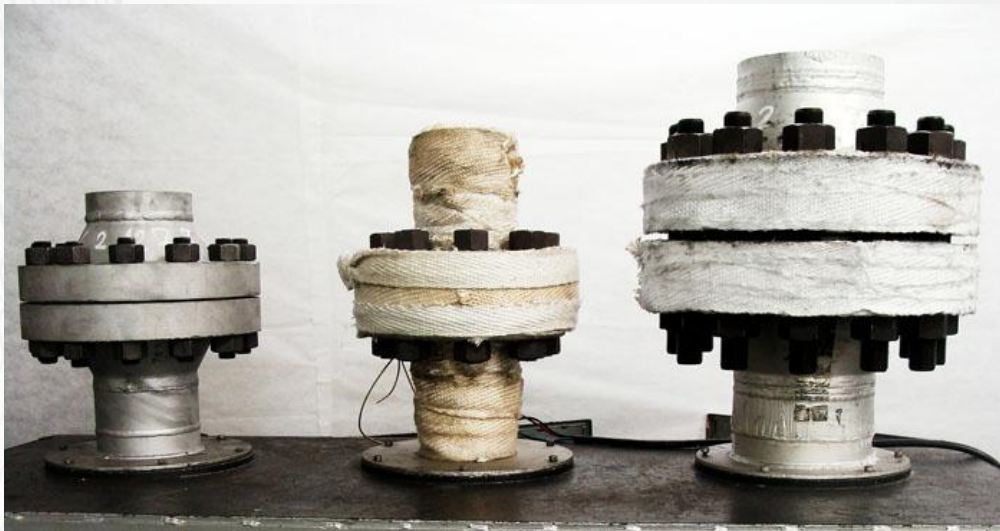


# Galvanic Cell Corrosion Test





# Gasket Testing



## Sealability

(Methane/Helium/Nitrogen)

## Flange Bending

## Hot Blow-out

## Thermal Cycling

(Amb to 400C/750F)

## Steel Flanges

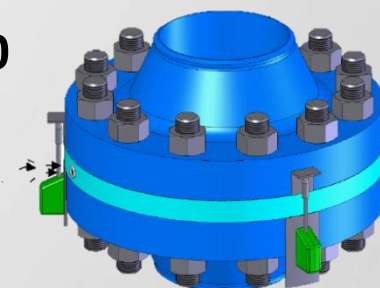
- 6" Class 900
- 4" Class 1500
- 8" Class 1500
- 3" Class 150
- 2" Class 300
- 4" Class 2500

## GRP

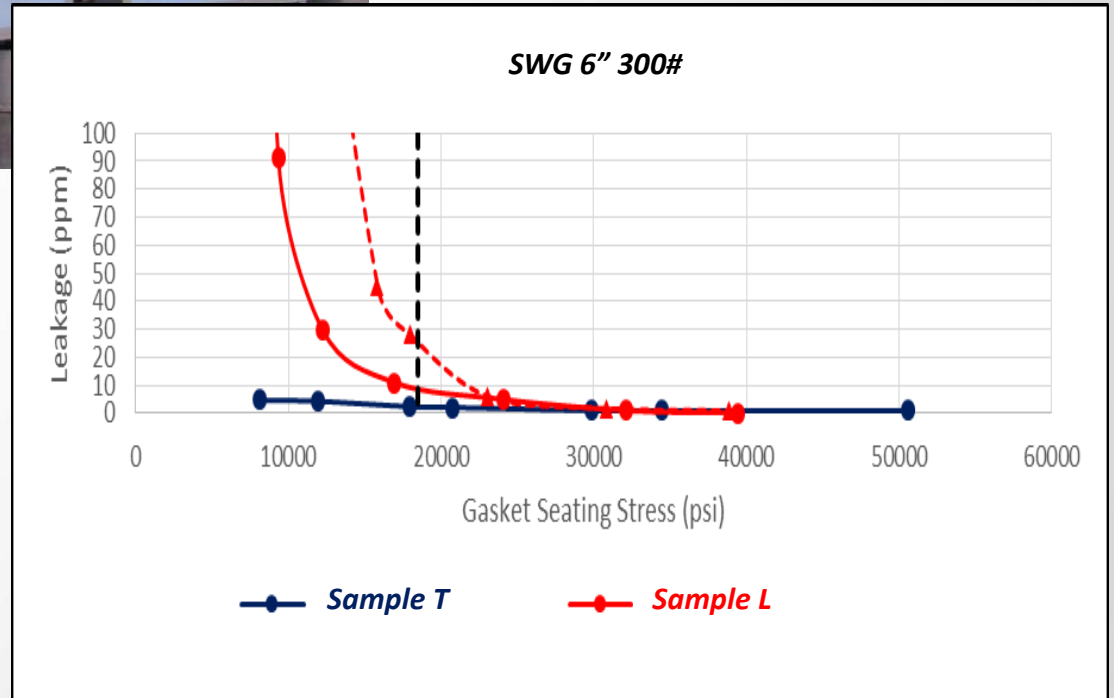
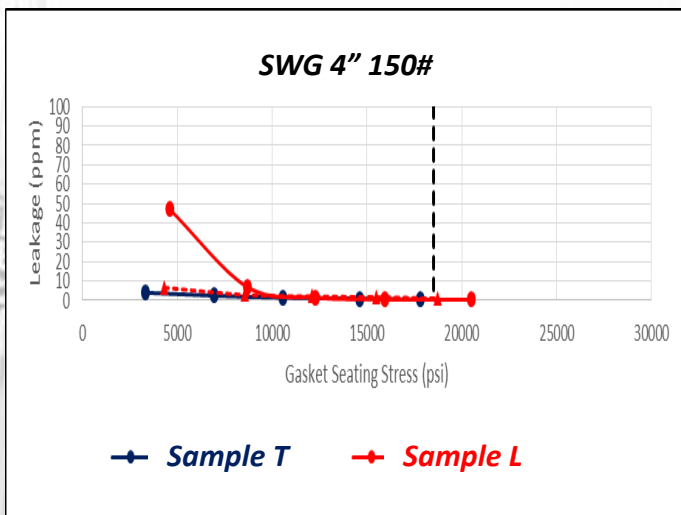
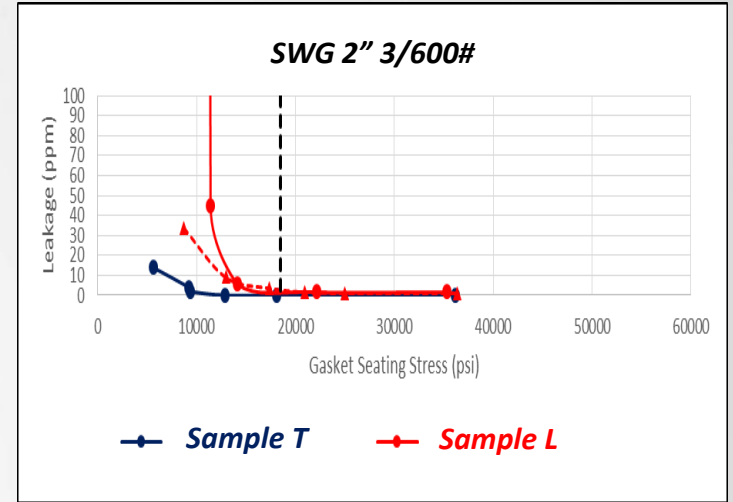
- 3" Class 150

## FADU

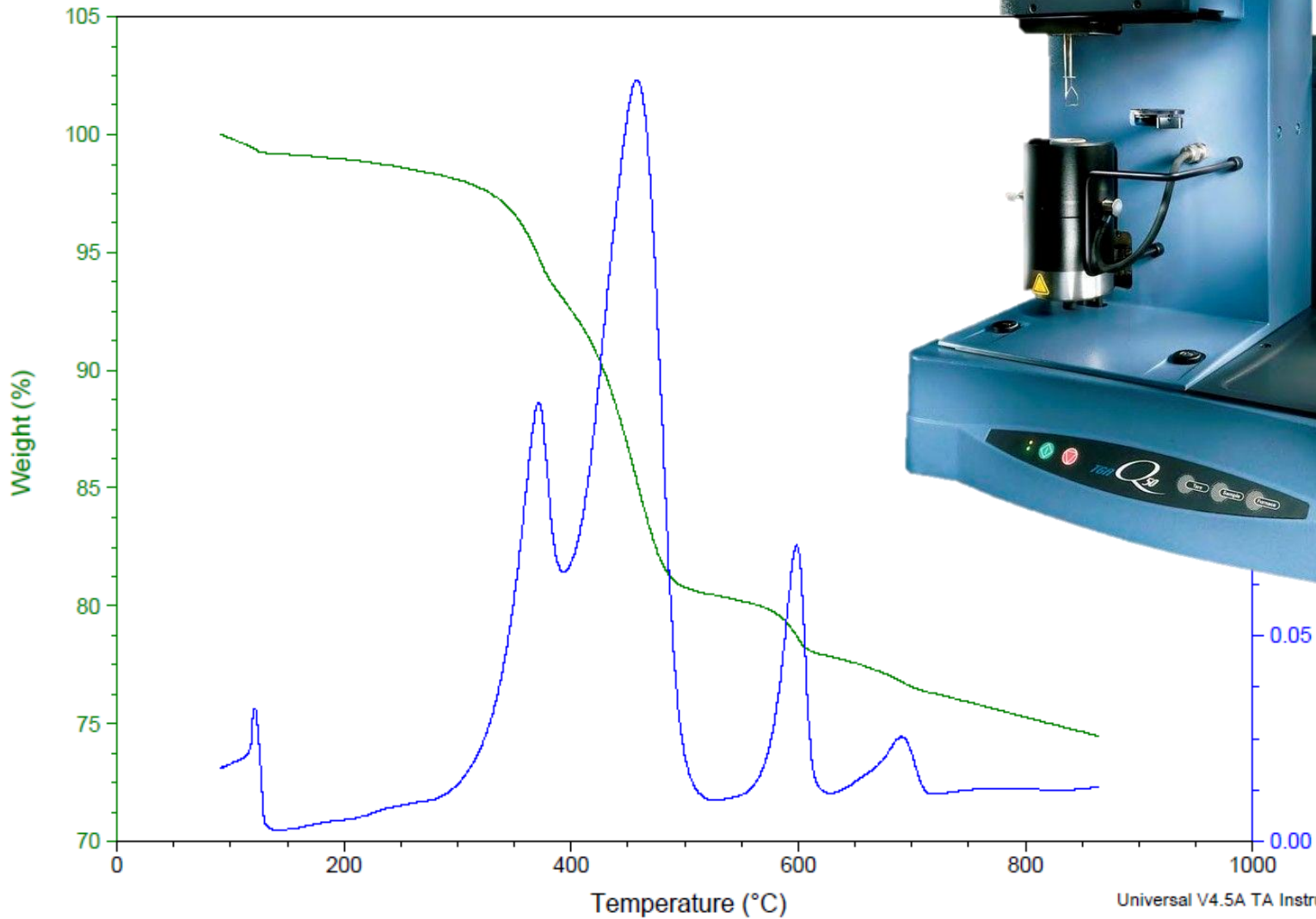
- 4" Class 150



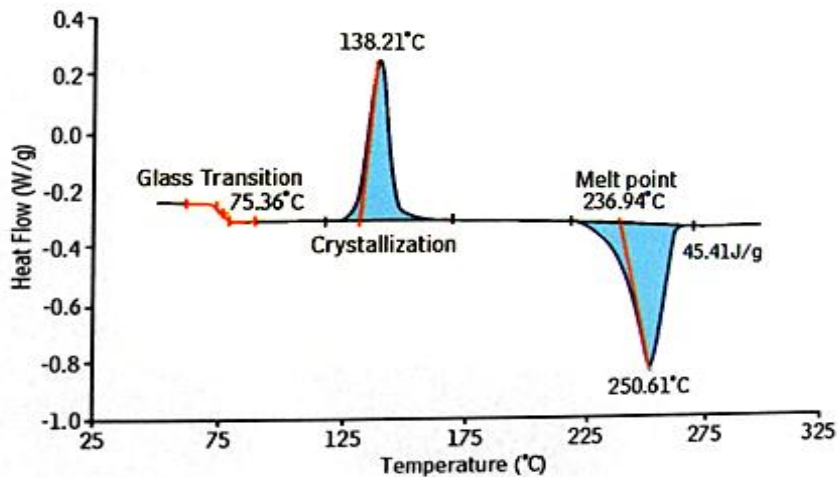
# Gasket Testing Results



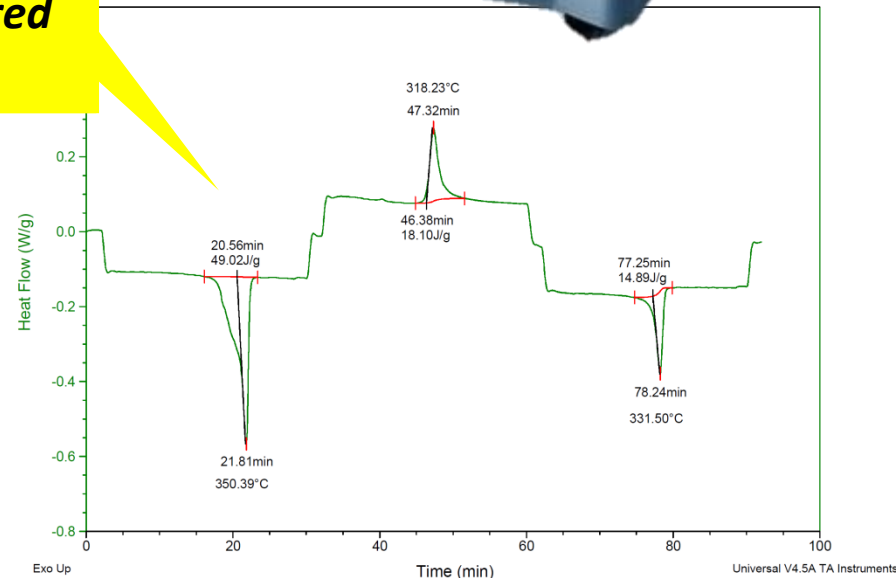
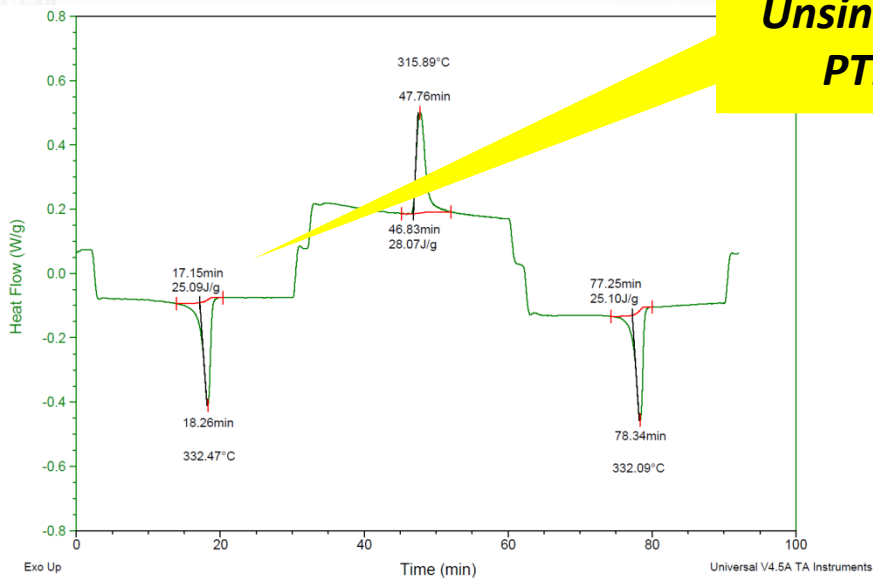
# Thermal Gravimetric Analysis - TGA



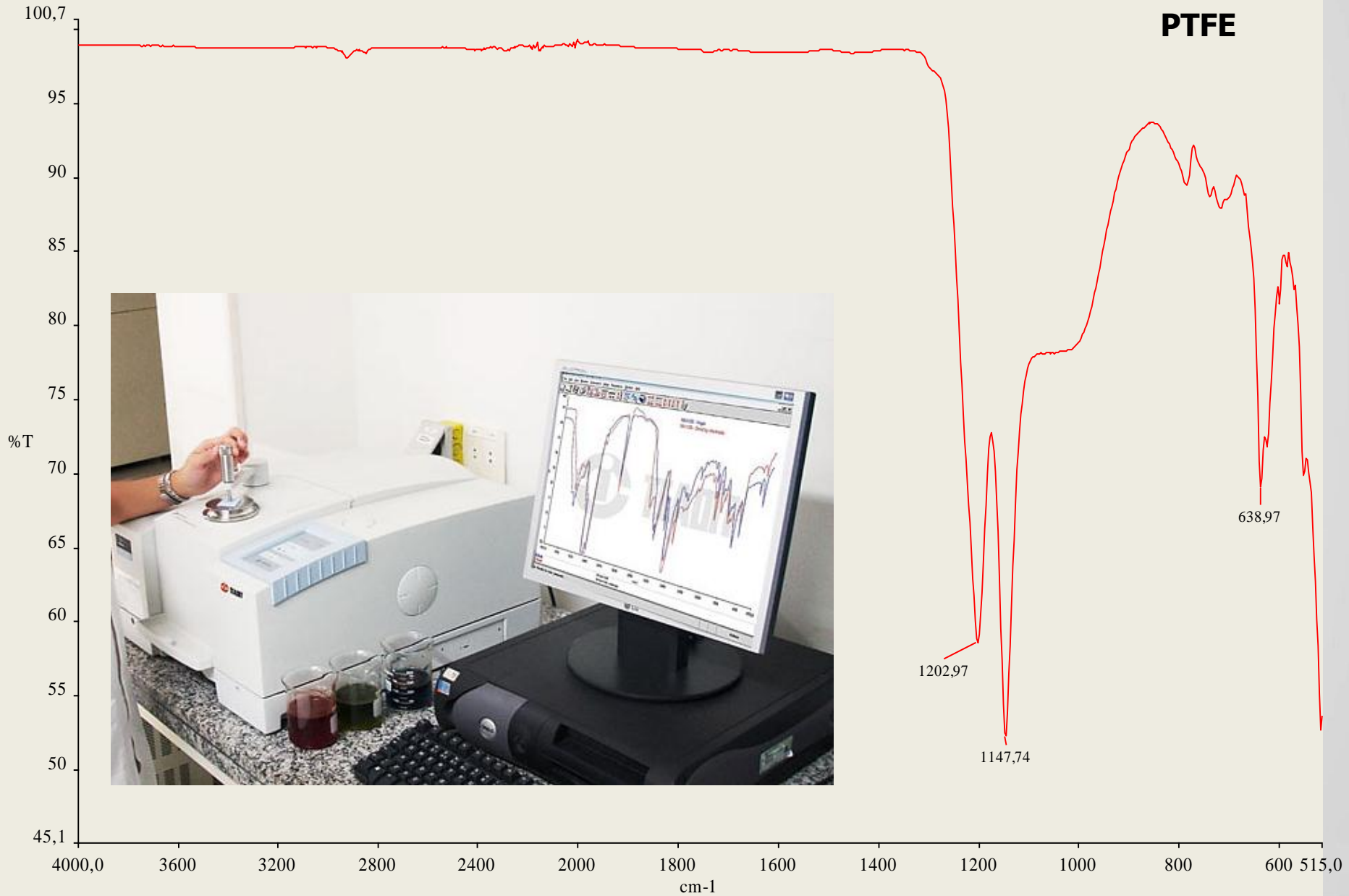
# Differential Scanning Calorimetry - DSC



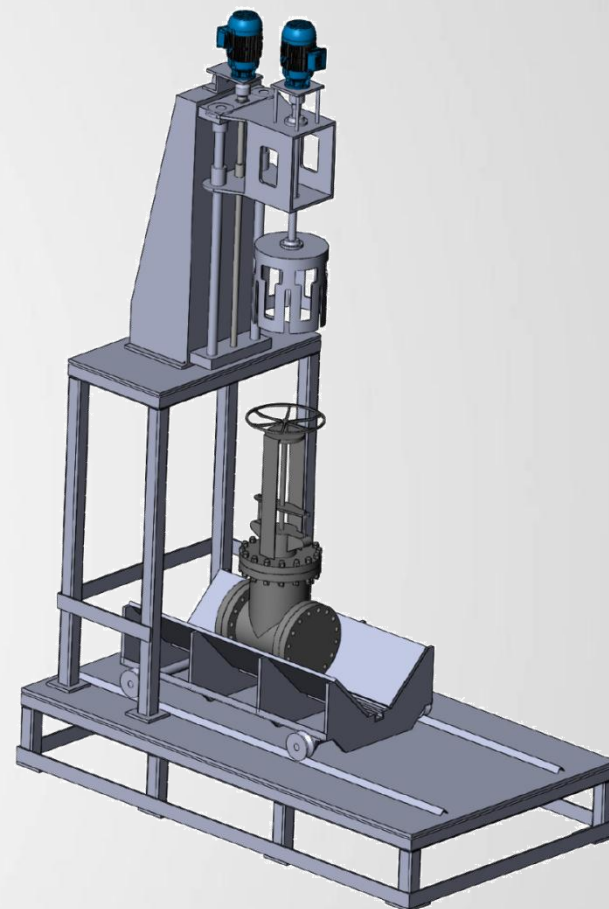
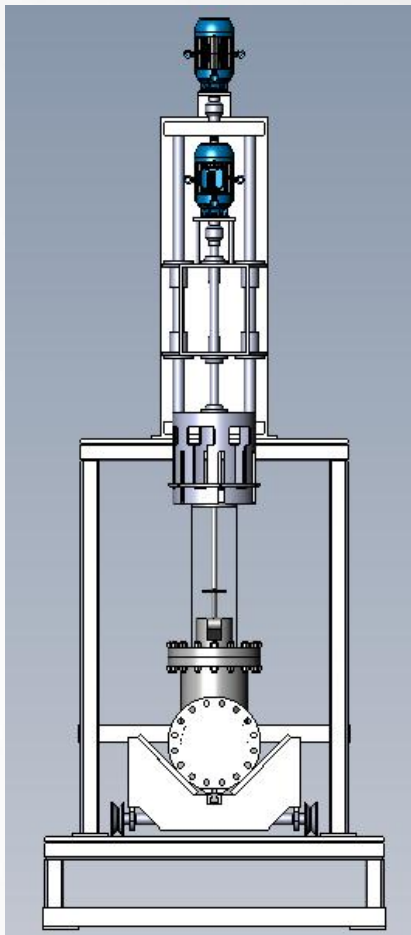
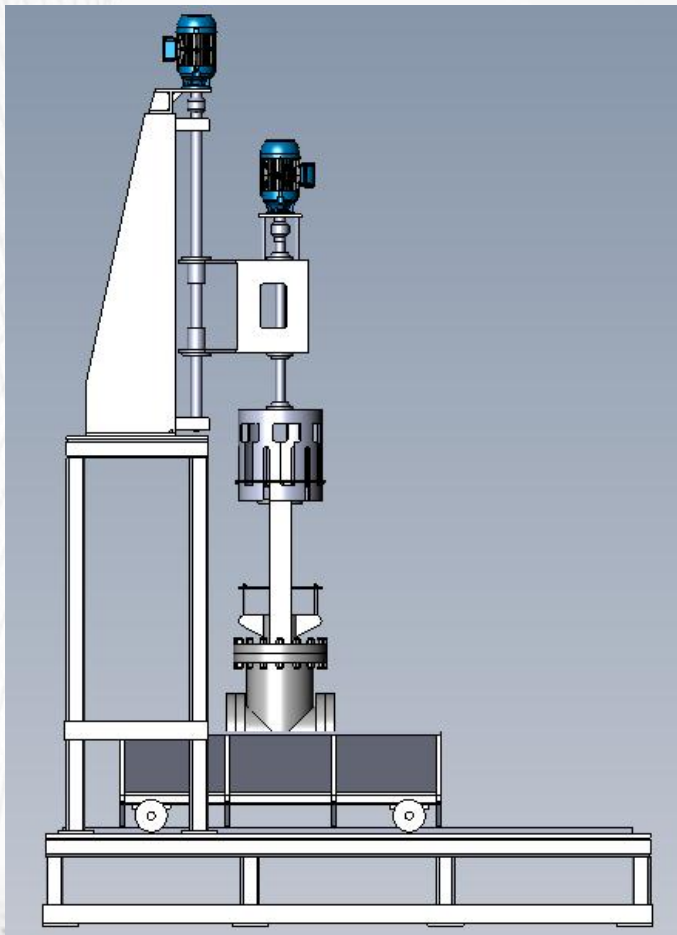
**Sintered and Unsintered PTFE**



# Infrared Spectroscopy



# API 624 Test Rig



NPS	API 602		API 600			API 603		API 623		
3/4"	800	1500				300				
1-1/2"	800	1500					600			
4"			300	900	1500	300	600	300	900	1500
12"			300	900	1500	300	600	300	900	1500
20"			300	900		300	600			



# VALVE PACKING & GASKET RESEARCH AND DEVELOPMENT DEVICES

# Thank You!

**Jose Carlos Veiga, P.E.**  
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**Teadit Ltda.**  
**Rio de Janeiro, Brazil**