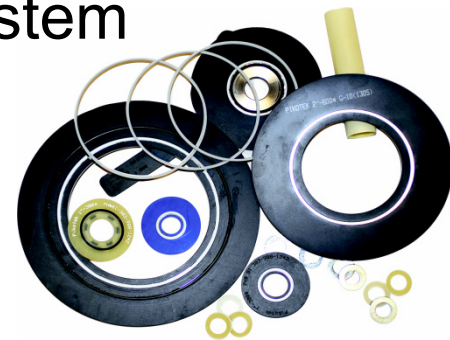


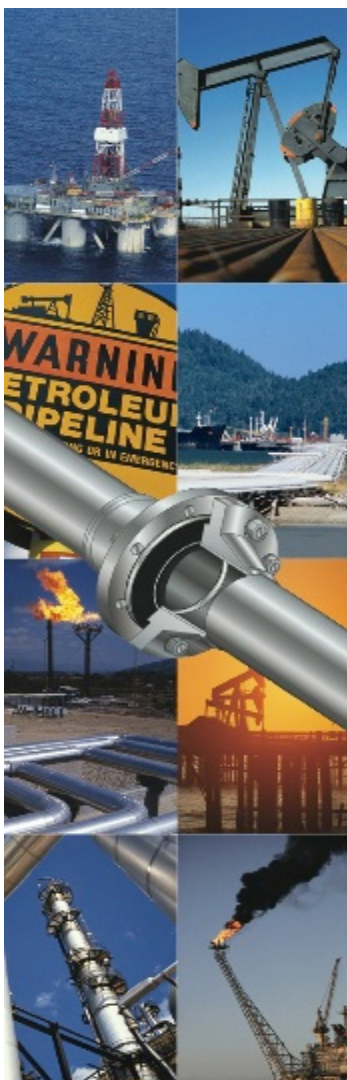
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## VCFS

VCS Firesafe Electrical Isolation  
Gasket and Sealing System





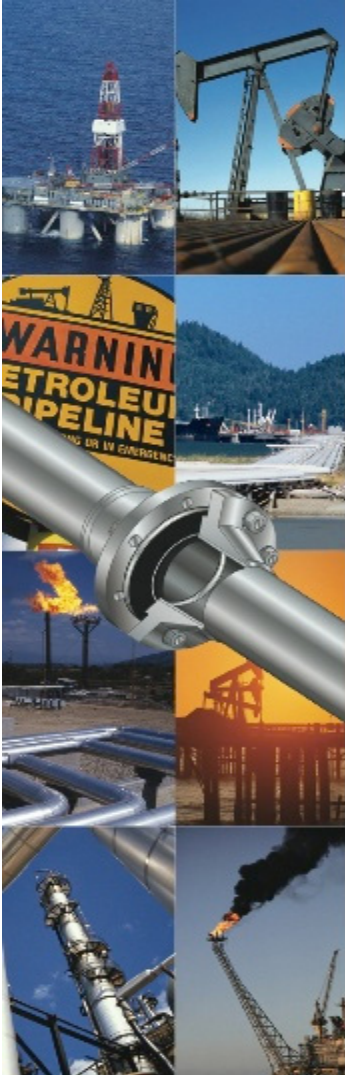
## The FireSafe VCS (VCFS)

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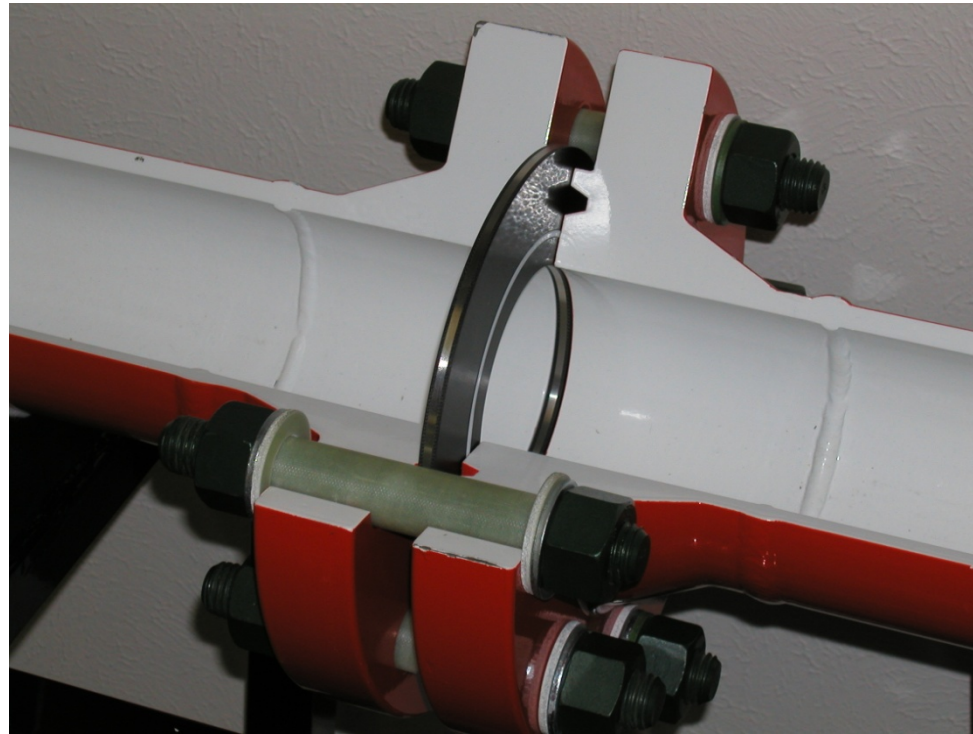
- First and Only Electrical Isolation Gasket System to pass API 6FB Fire Test
- Based upon proven Pikotek VCS technology
  - Over 20 years of field proven reliability
  - Hundreds of Thousands installed world-wide
  - The standard of reliability in sealing and electrical isolation
- Extensive testing history still applicable
- The Firesafe VCS maintains all of standard VCS features and functions
- Patent Pending

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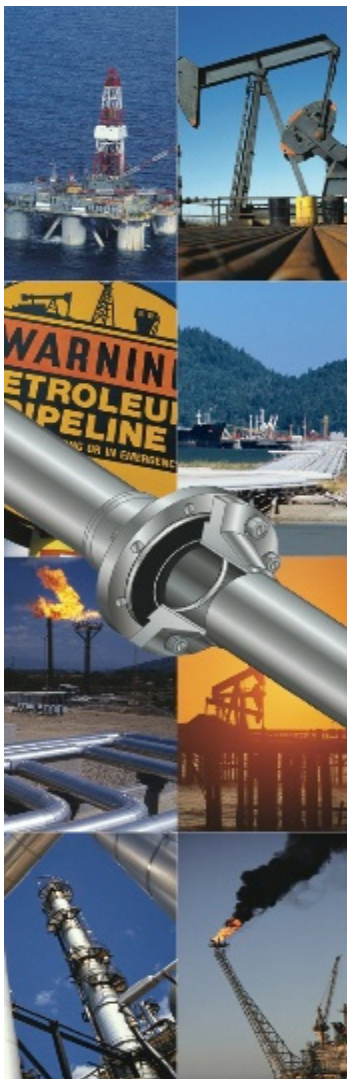


## VCS Gasket in Cut-Away

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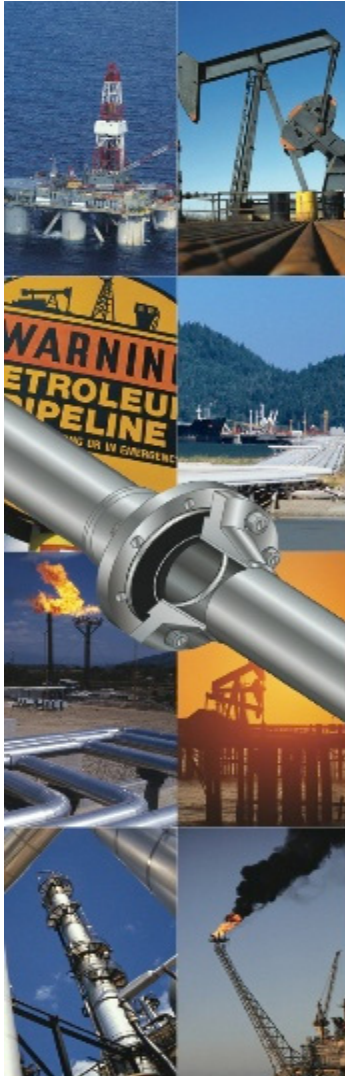


## VCS History & Background

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- ARCO Testing – Stage 1
  - Flange – 6” 1500#
  - Pressure – 5000psi
  - Media
    - Water
    - Crude Oil
    - Gas mixture **H<sub>2</sub>S, CO<sub>2</sub>, CH<sub>4</sub>**
  - Gaskets tested:
    - Phenolic Ring (RTJ)
    - Phenolic gasket with Viton seals
    - GRE gasket with Viton seals
    - “VCS” steel core GRE with Viton seals

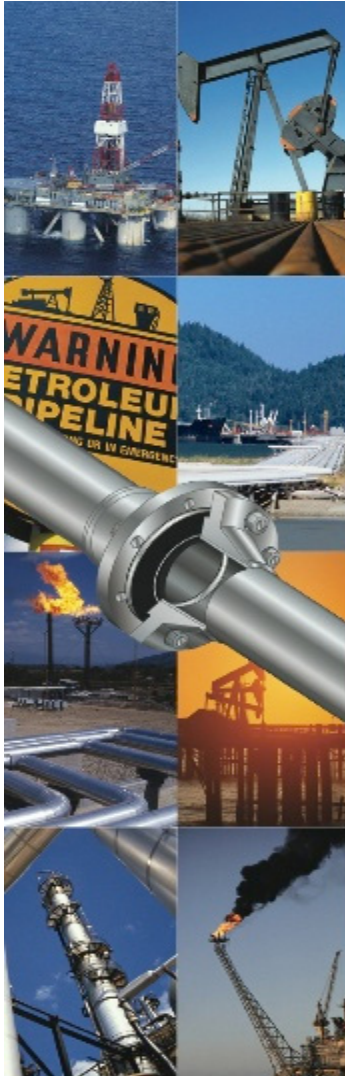


## VCS History & Background

---



- Protocol
  - 2 week cycle – 7 days 120C, 7 days -40C
- ARCO Testing – Results
  - 1 cycle (2 weeks)
    - GRE and Phenolic with Viton lost 800psi
  - 2 cycles (4 weeks)
    - GRE and Phenolic with Viton FAILED
  - 4 cycles (8 weeks)
    - Phenolic RTJ FAILED – cracks propagated, gas leakage, and moisture detected.
  - Only remaining design is VCS – GRE laminate, SS core, Viton o-rings.

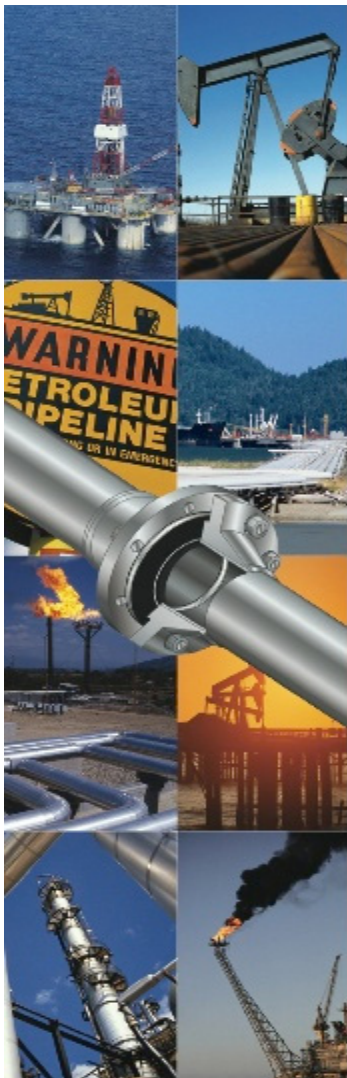


## VCS History & Background

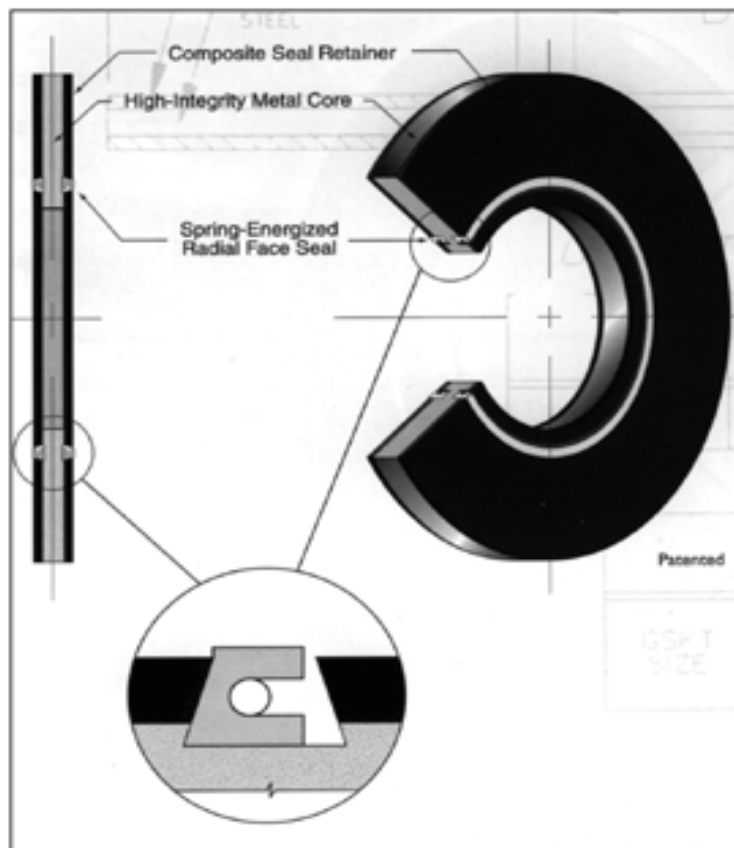
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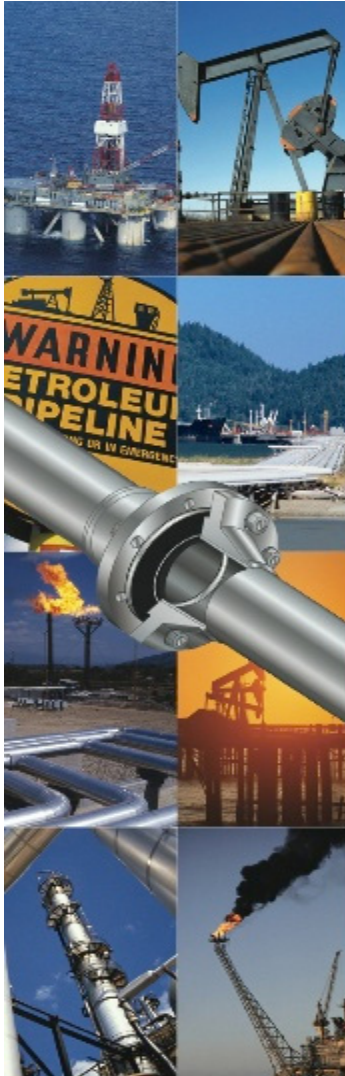
- ARCO Testing – Stage 2 (VCS Only)
  - Flange – 6” 1500#
  - Pressure – 7500psi
  - Media
    - Water
    - Crude Oil
    - Gas mixture **H2S, CO2, CH4**
  - Protocol
    - 2 week cycle – 7 days **150C**, 7 days -40C
- RESULTS: 8 cycles (16 weeks)
  - NO leaks and NO pressure drop



# VCS History & Background

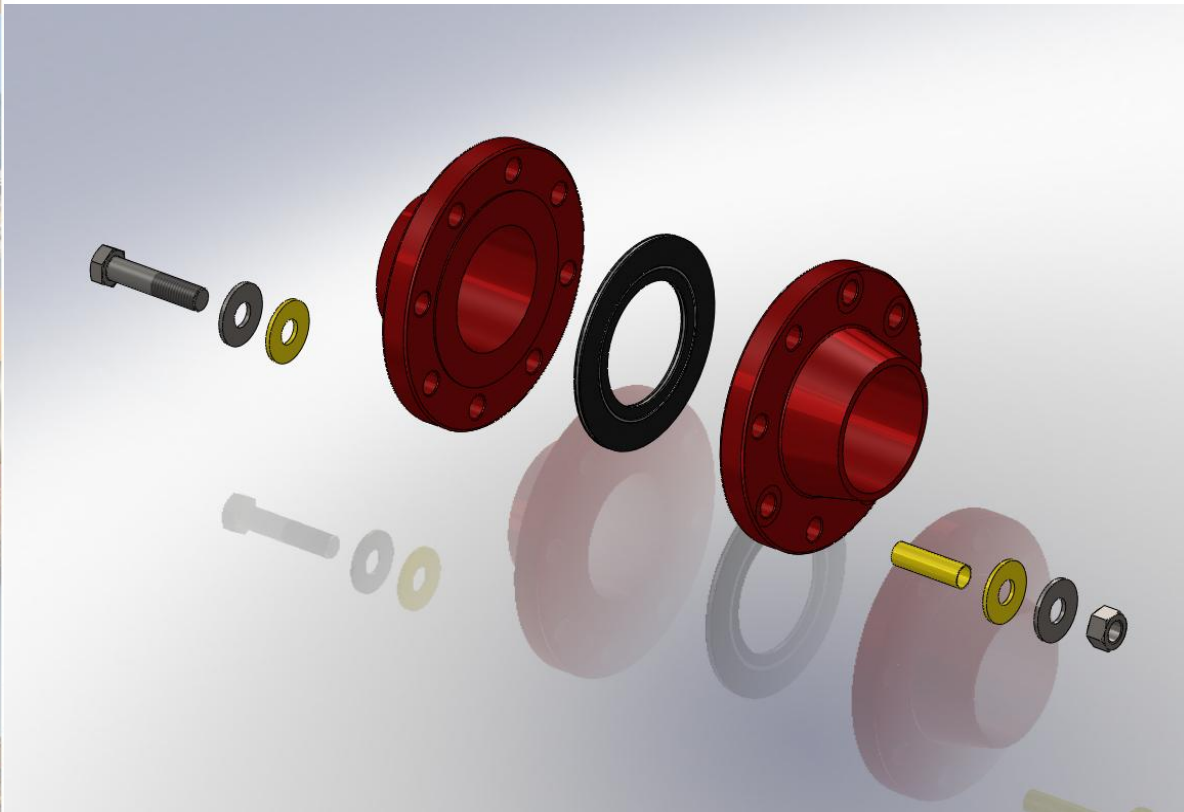


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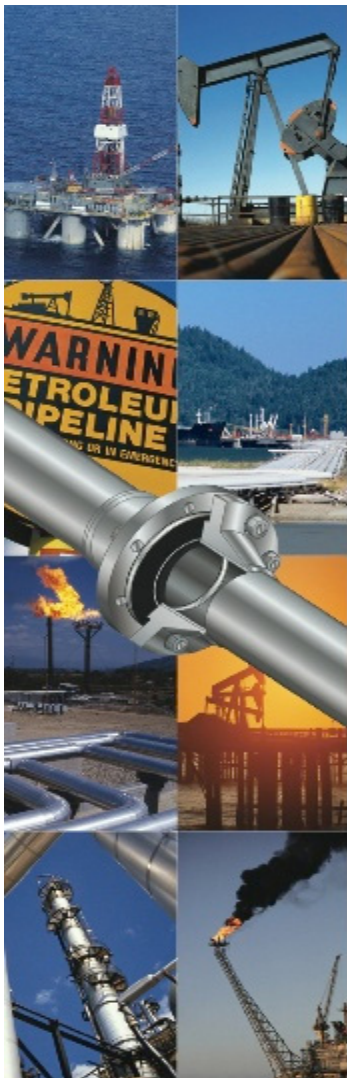


# VCS History & Background

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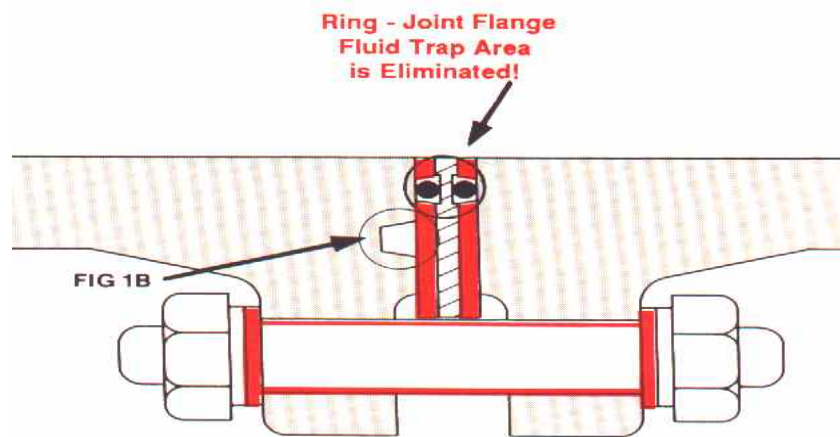
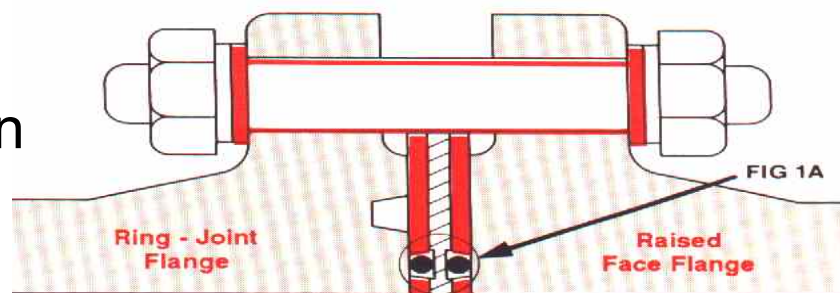


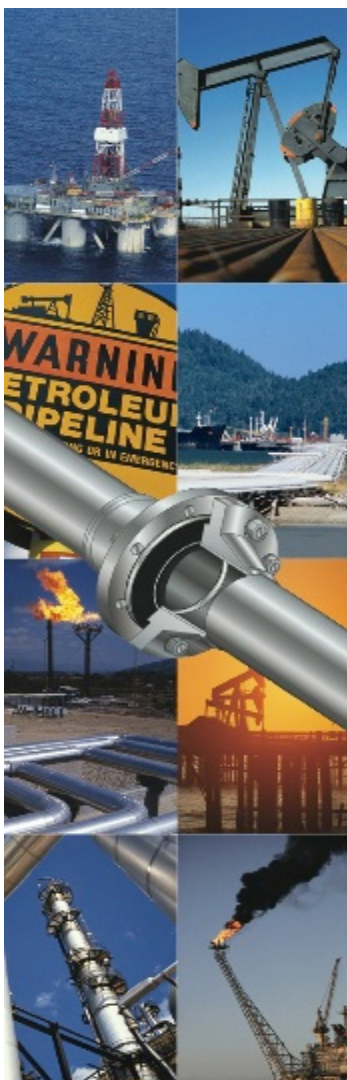


# VCS History & Background



Isolation  
outlined in  
RED





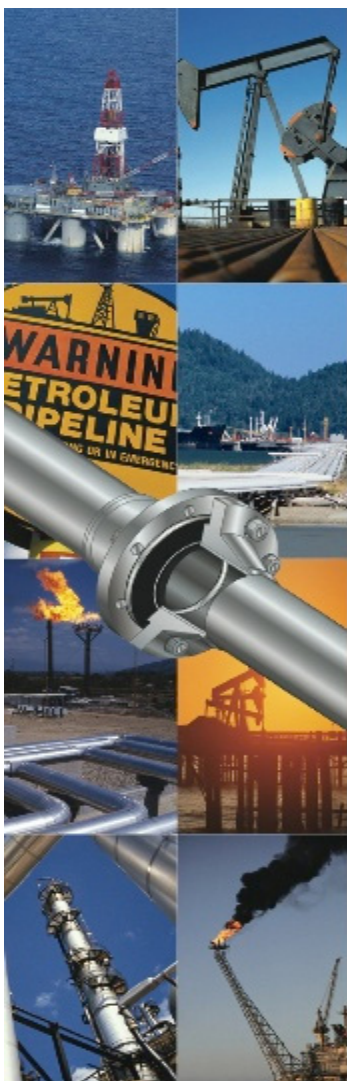
## VCS Applications

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- Provide electrical flange isolation for cathodic protection systems
- Separate dissimilar metals in high-pressure applications to eliminate galvanic corrosion
- Replace failure prone monolithic joints and phenolic insulating gaskets
- Eliminate flange face corrosion and flow-induced erosion in high-pressure/wet CO<sub>2</sub>/H<sub>2</sub>S service
- Replacing RTJ gaskets in wellheads to eliminate flange face corrosion and flow-induced erosion (i.e. entrained sand)
- Mitigate corrosions in high-pressure water injection/produced water applications

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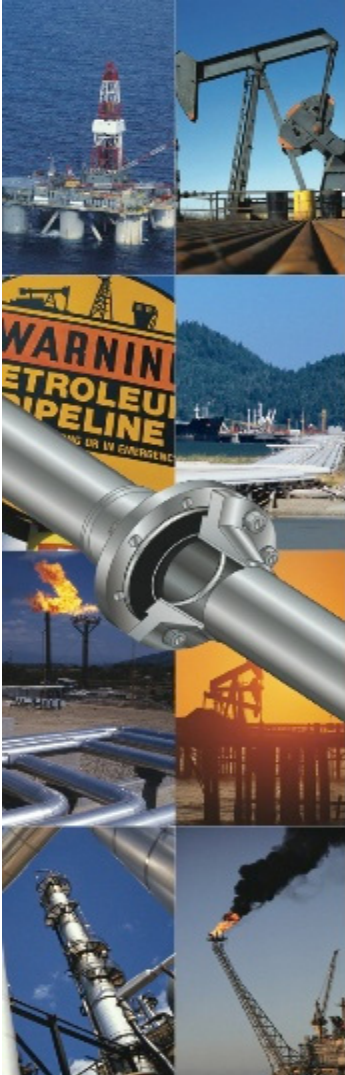


## VCS Characteristics

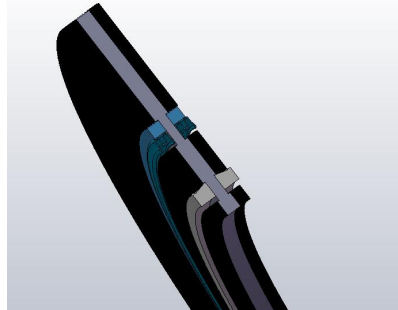


- **Reliably seals up to ANSI class 2500 and API 10,000**
- **Excellent electrical isolation properties**
  - Dielectric strength 750-800 VPM
- **Water absorption - NEMA G-10/FR4 = .05%**
  - Glass Phenolic = 1.00%
  - Canvas Phenolic = 1.20%
  - Paper Phenolic = 1.10%
  - High water absorption can ruin pipeline isolation and cause severe corrosion of pipeline and flange face.
- **Excellent Compressive Strength**
  - G-10 = 65000psi, G-11 = 55000psi
    - Glass Phenolic = 50000
    - Canvas Phenolic = 37000
    - Paper Phenolic = 36000
- **Temperature Ratings:**
  - G-10 = 150C, G-11 = 200C

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## The FireSafe VCFS\*

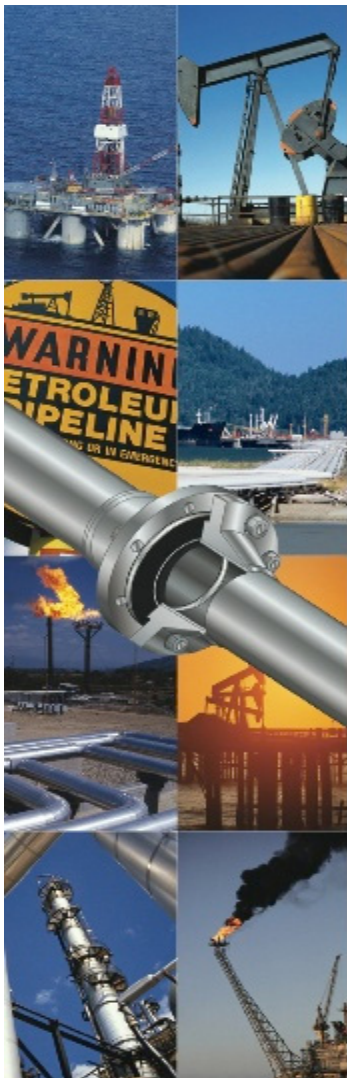


- Proven VCS Primary Seal
- Inconel “E” Ring Backup Seal
- Firelock Backup Ring
- Patented HCS (hardened coated steel) Isolation Washers
- CERTIFIED TO API 6FB FIRE TEST

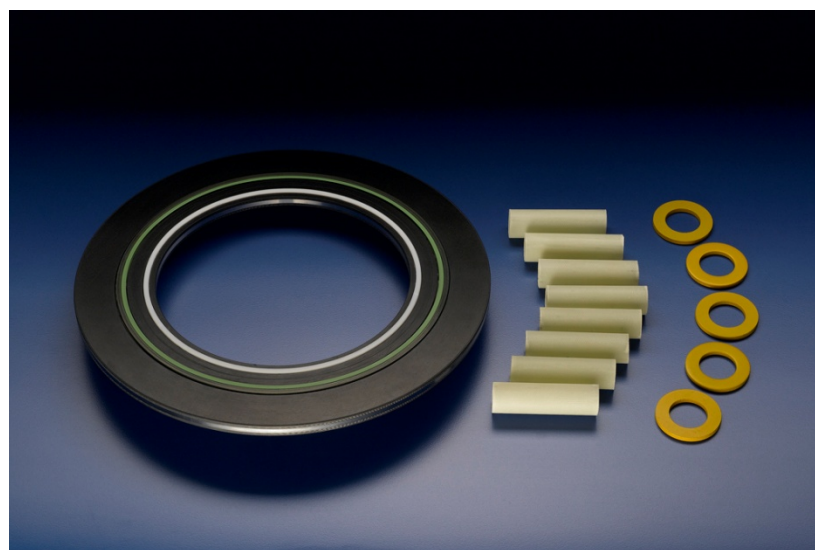
### “THE HIGH INTEGRITY FIRESAFE ISOLATION AND SEALING SYSTEM”

\* Note: The “FS” or “Fire Safe” designation denotes only that this gasket has successfully passed the API 6FB fire test. Due to the fact that every fire is unique and many uncontrolled variables are present, no other claims regarding suitability or performance in a fire are made. Each designer, user and/or operator will need to assess their individual situation when deciding to install FS style gaskets.

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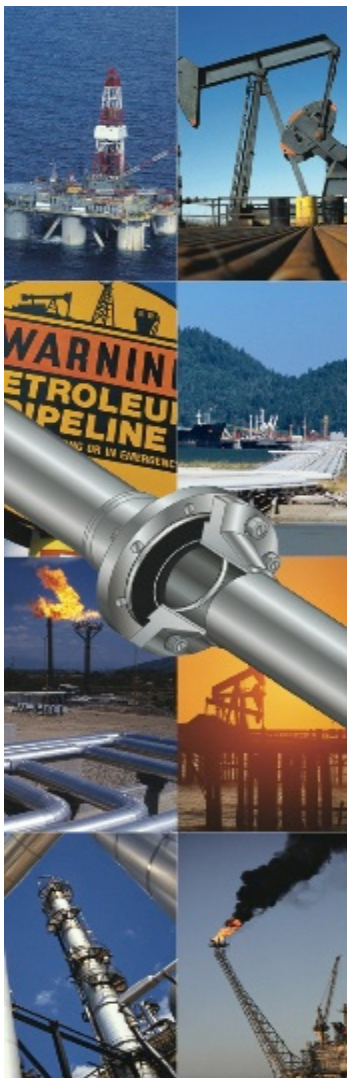


## The FireSafe VCFS



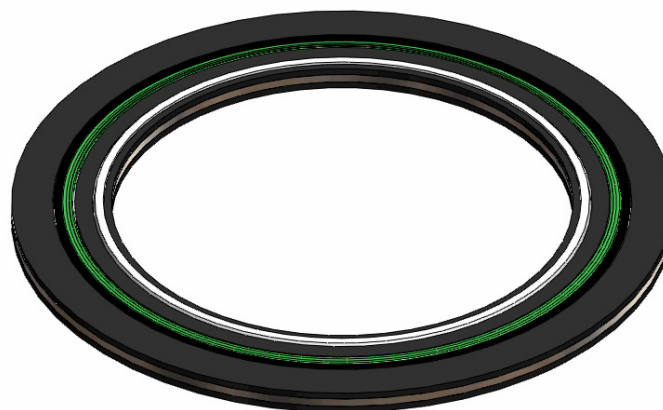
**THE WORLDS ONLY FIRESAFE INSULATING SEALING SYSTEM**

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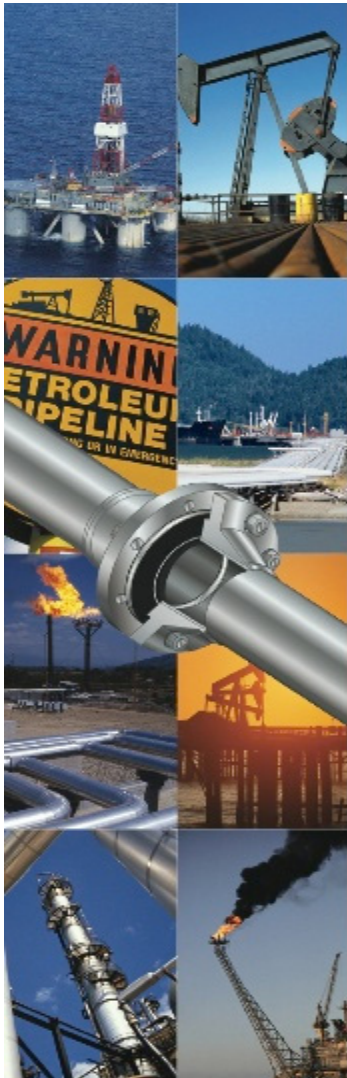


# VCFS Construction

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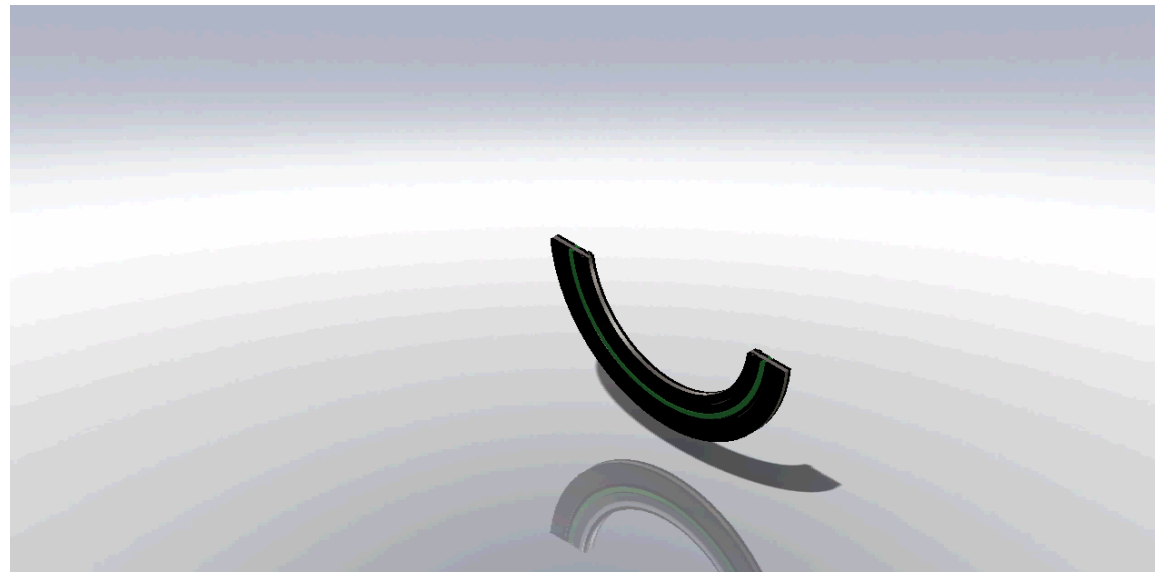


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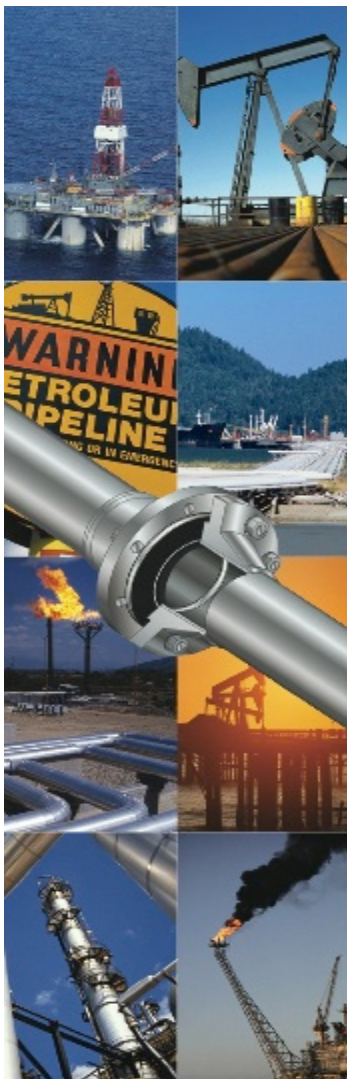


# VCFS Construction

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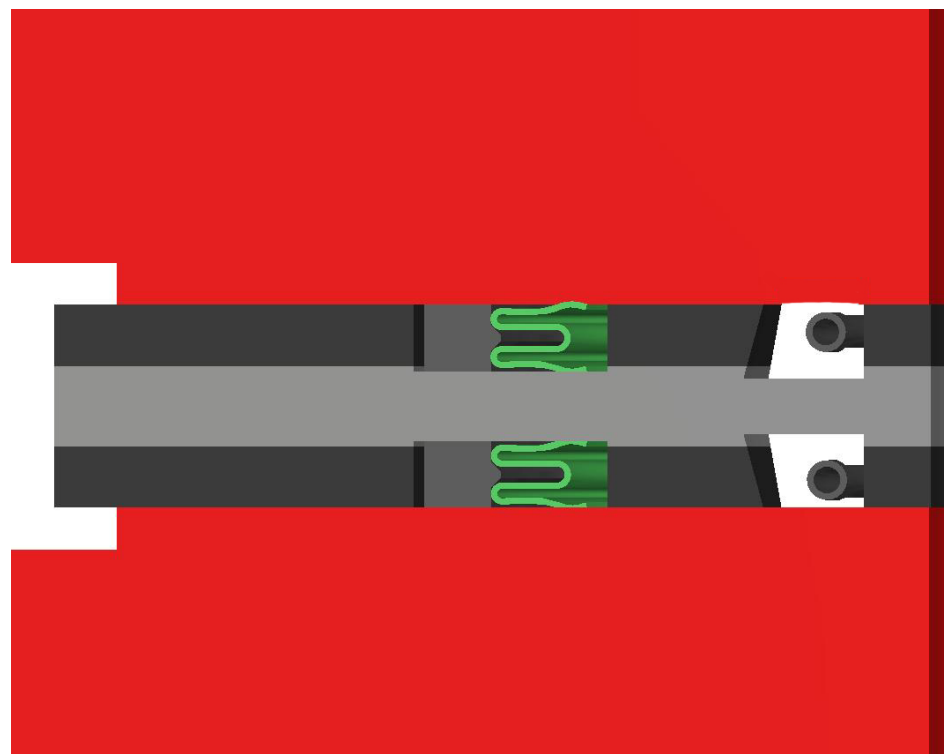


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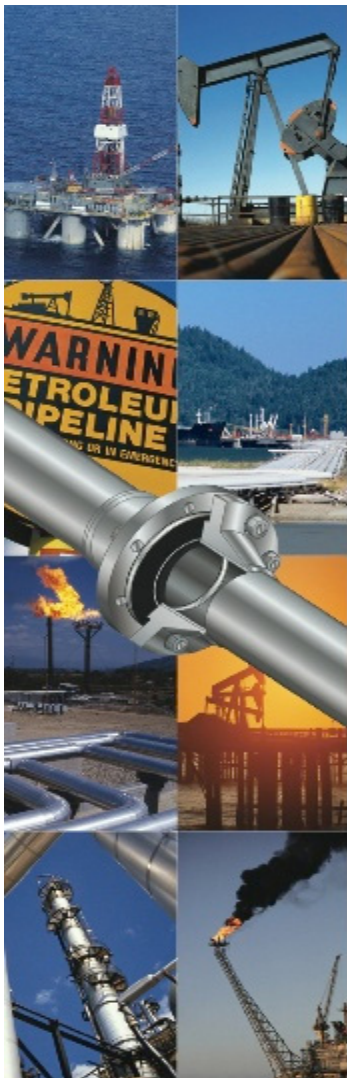
# VCFS Normal Operation

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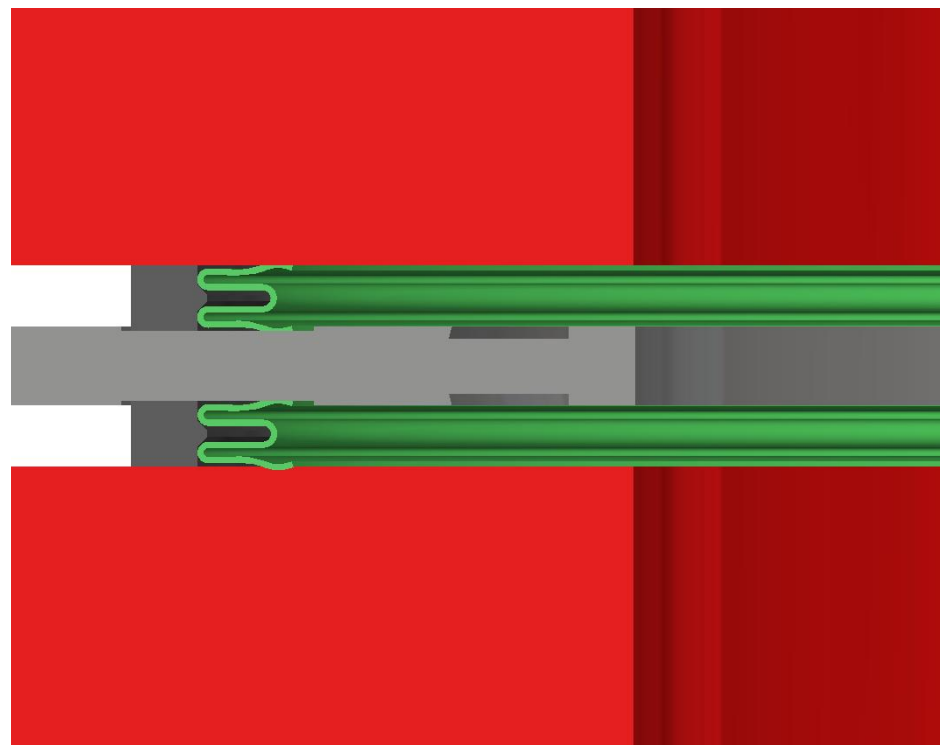
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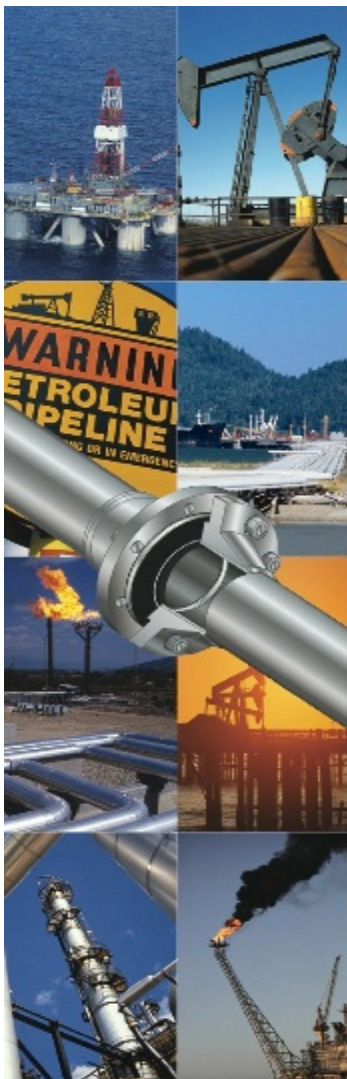


## VCFS During Fire

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# API 6 FB Fire Testing



**Fire Test Report**  
API Standard 6FB, Third Edition  
*Performed for*

**PIKOTEK**  
[www.pikotek.com](http://www.pikotek.com)

←————→

6 inch Class 300VCFS Isolation Gasket  
CS / Dielectric B/U rings  
.110 Dielectric E-Rings  
Dielectric Washers and Isolation Sleeves

Project Number: 20833-G  
May 7, 2008

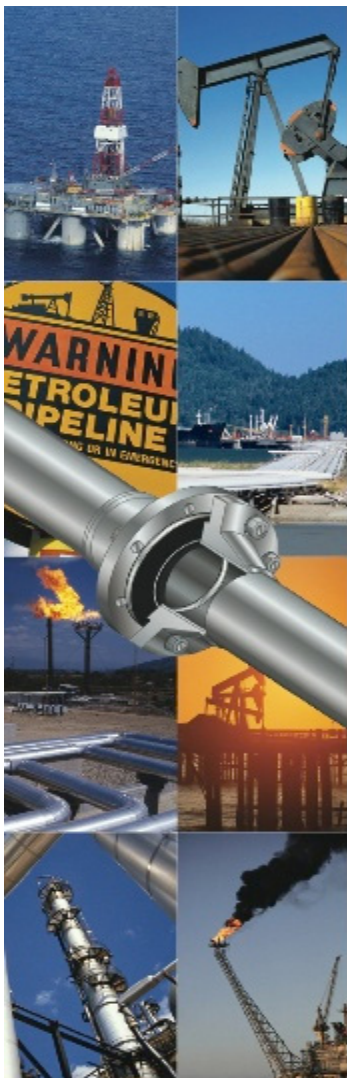
←————→

*Performed by*

**YARMOUTH RESEARCH AND TECHNOLOGY**

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[www.yarmouthresearch.com](http://www.yarmouthresearch.com)

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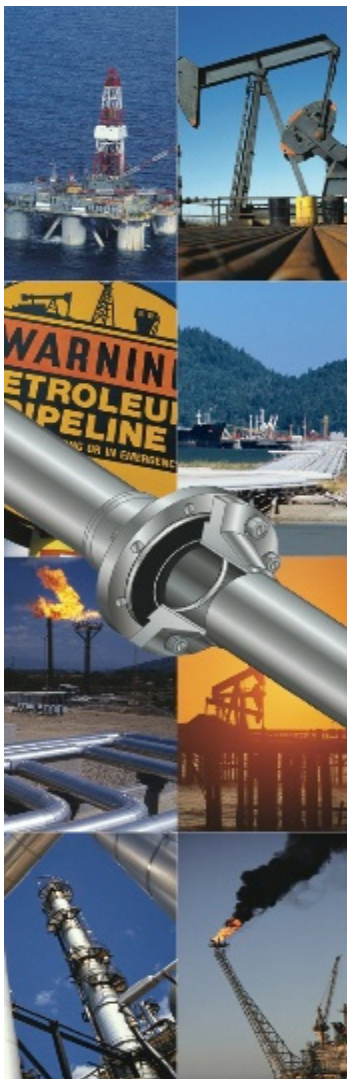


# API 6 FB Fire Testing

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Figure 1 - Gasket Before Test



## API 6 FB Fire Testing

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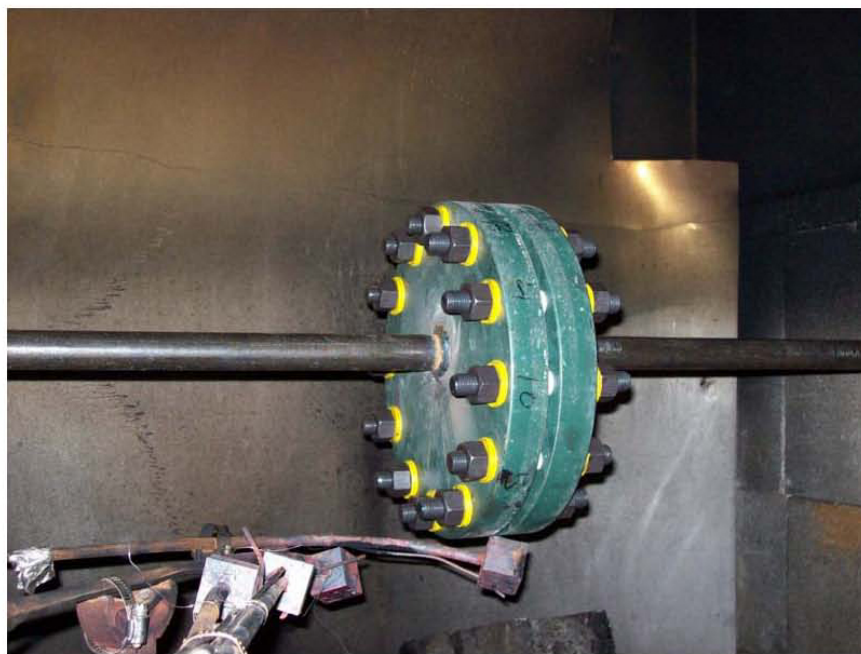
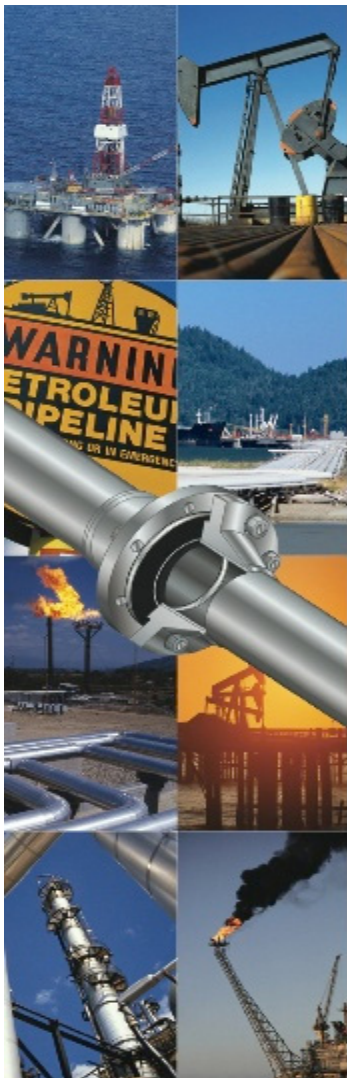


Figure 2 – Flange Assembly



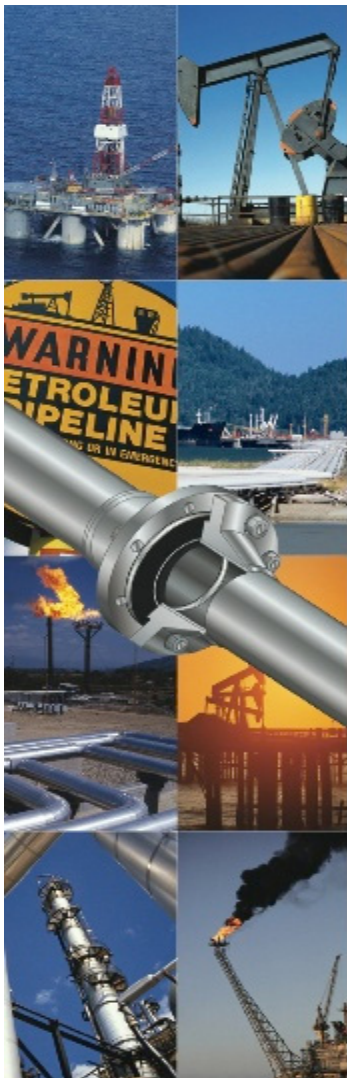
## API 6 FB Fire Testing

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Figure 3 - Gasket Fire Test

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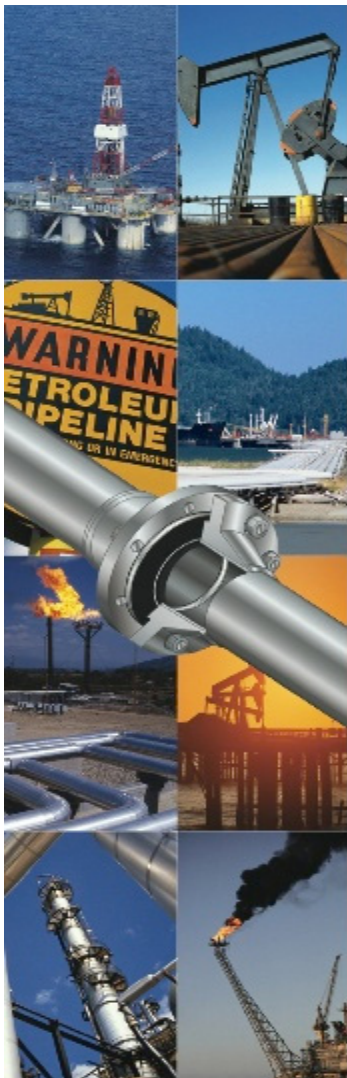
## API 6 FB Fire Testing

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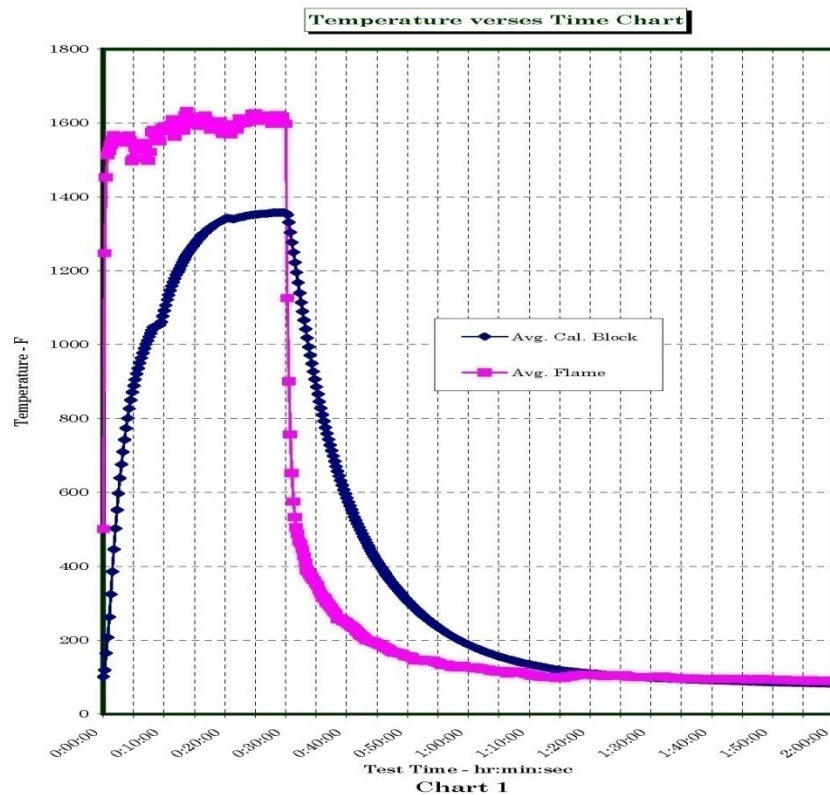


Figure 4 - Gasket Fire Test

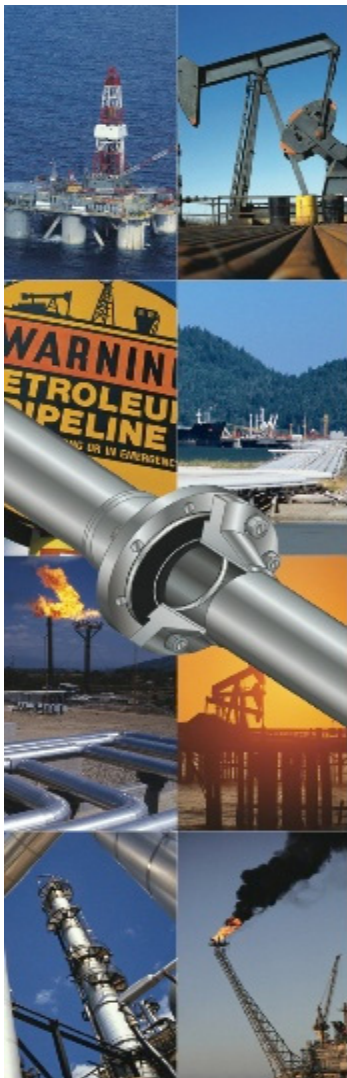
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# API 6 FB Fire Testing Temperature vs. Time



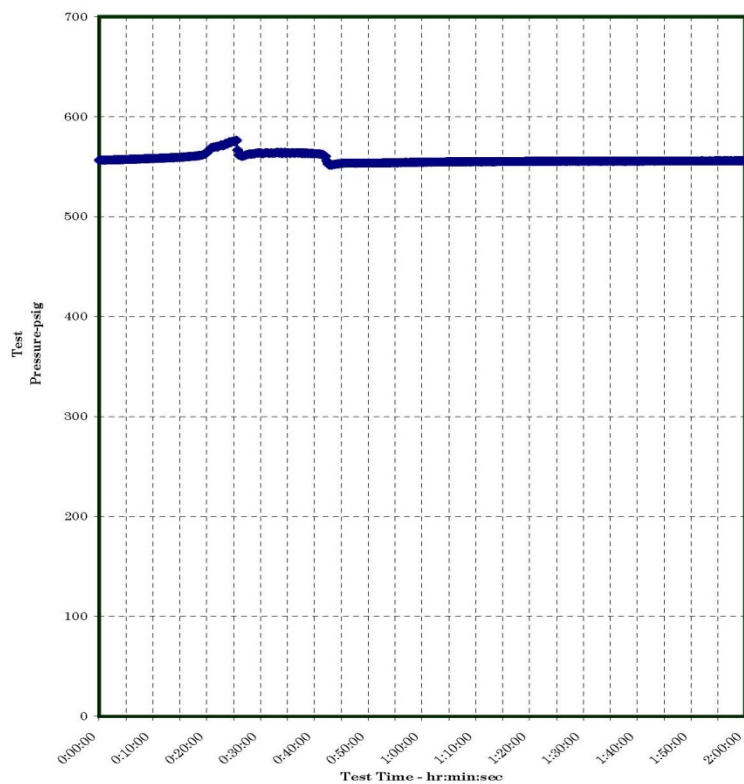
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# API 6 FB Fire Testing Pressure vs. Time

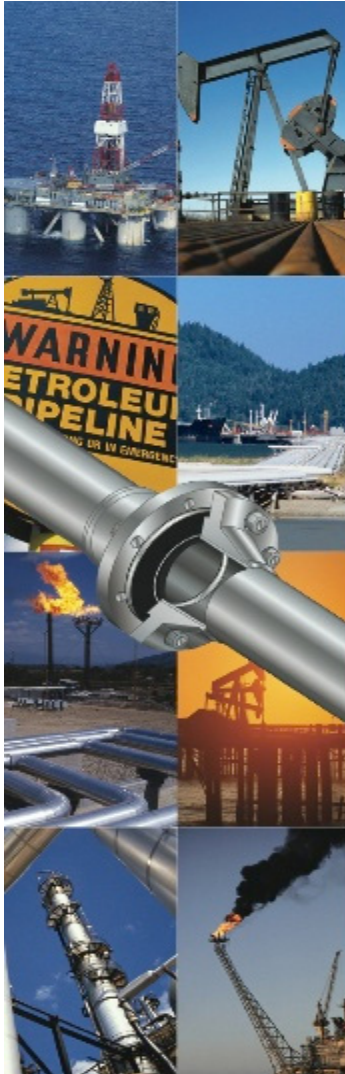


Pressure versus Time Chart



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## API 6FB TEST RESULTS

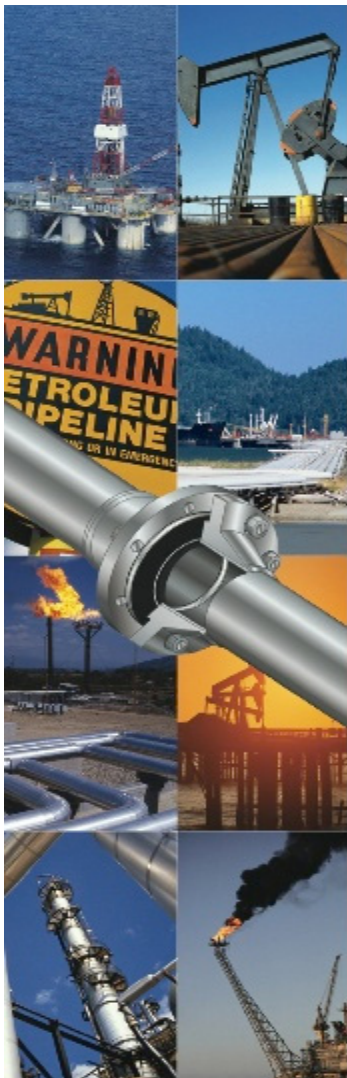


Variable	Data Recorded
Average System Pressure	557 psi
Average Flame Temp (thermocouples)	1580°F
Time to reach average calorimeter temperature of 1200°F	12 min 30 seconds
Total Burn Time	30 minutes

### Key Gasket Performance Measurements:

Variable	Data Recorded
Flange-to-Flange Isolation	250 MOhms
Flange-to-Bolt Isolation (average of 4 measurements)	45.3 GOhms
Leak Rate During Burn/Cooldown Cycle	5 ml/min (allowable = 23.9ml/min)
Leak Rate During Repressurization Cycle	0 ml/min (allowable = 23.9ml/min)
Pass API 6FB Fire Test Conditions	YES

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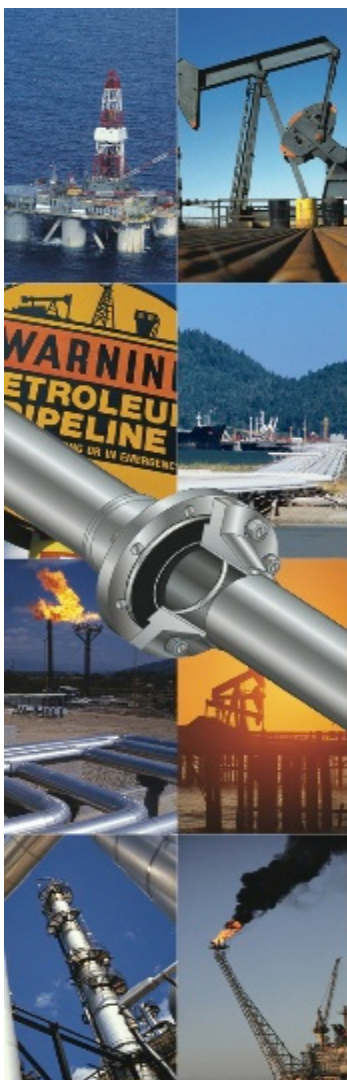


# The High Integrity Solution

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# Pikotek HCS Washer System *pikotek*

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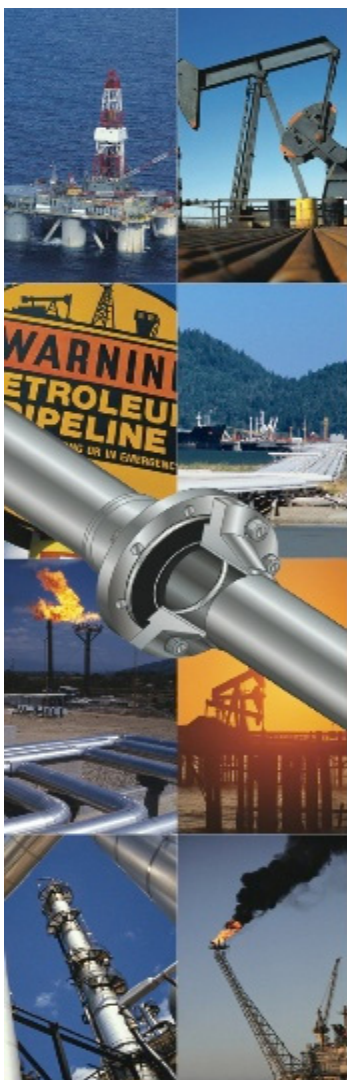


Figure 2 – Close-up of two HCS washers

Patent Pending

- HCS = Hardened Coated Steel
- Replaces Glass Reinforced Epoxy Isolation Washers
- Not susceptible to breakage due to point loading or over torque
- Cannot be installed backwards

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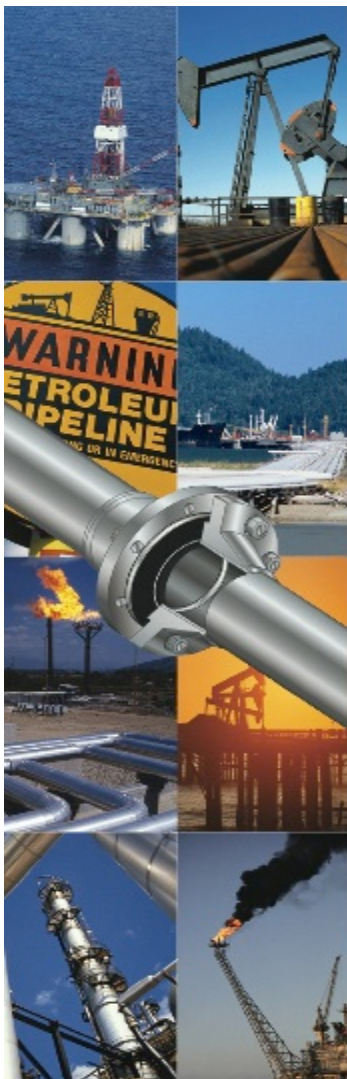


# HCS Washer Testing

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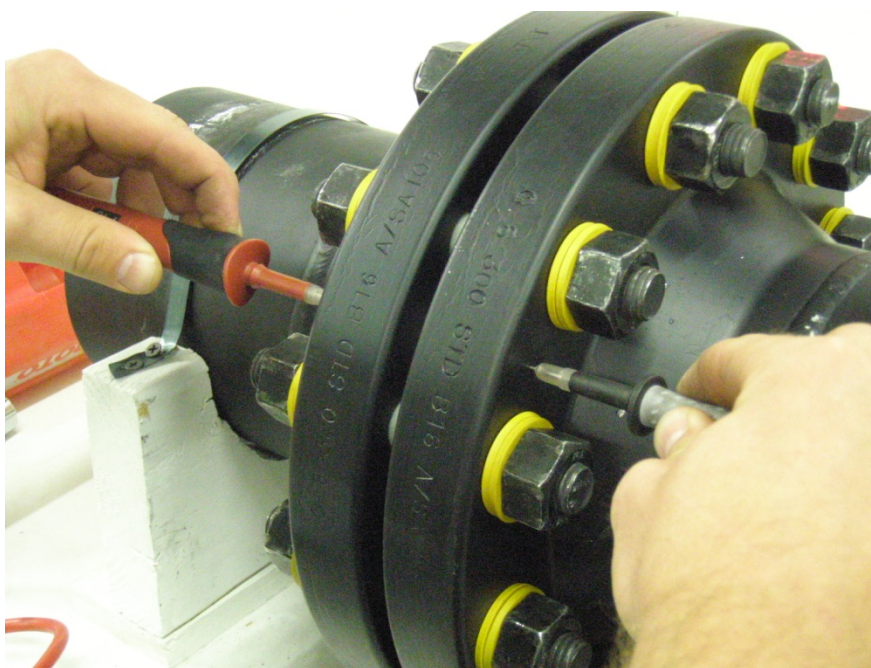


- **Test Series #1:**
  - ANSI 6" 300# Painted Flange and VCS Isolation Gasket
  - Two HCS Washers per Nut
  - Bolted up to 150 ft. lbs. and isolation measured
  - Unbolted then re-bolted twice more
- **Test Series #2**
  - Removed Paint from the Flange
  - Only a Single HCS Washer used
  - Bolted up to 150 ft. lbs. and isolation measured
  - Unbolted then re-bolted twice more



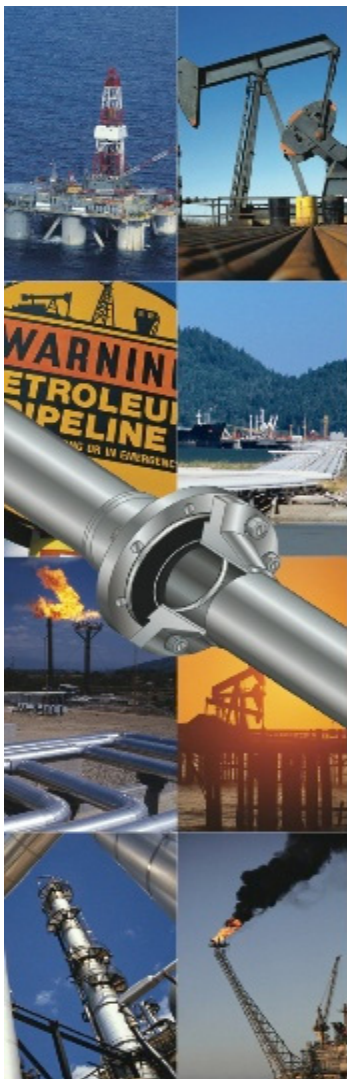
## HCS Washer Testing

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**A flange-to-flange measurement being taken**

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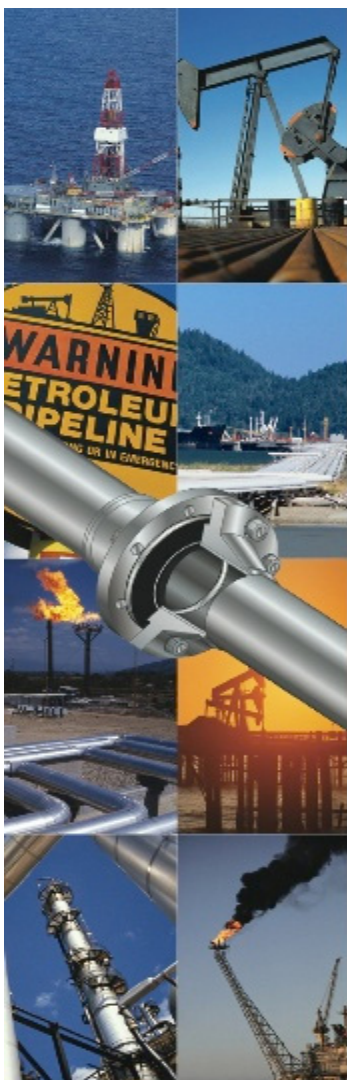
## HCS Washer Testing

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Resultant measurement of resistivity

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## HCS Washer Testing

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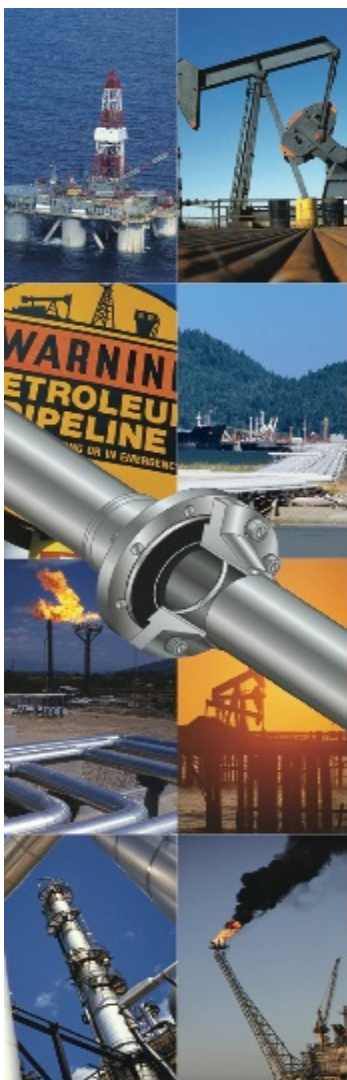


- **Isolation Values for Test Series 1:**

- Flange to Flange isolation remained at 200 GOhms during all three bolt-ups
- The Flange to Bolt isolation remained at 200 GOhms during all three bolt-ups.

- **Isolation Values for Test Series 2:**

- Flange to Flange isolation:
  - Bolt-up #1 - 70 Gohms
  - Bolt-up #2 - 40 Gohms
  - Bolt-up #3 - 20.3 Mohms
- Flange to Bolt isolation:
  - Bolt-up #1 - 158 Gohms
  - Bolt-up #2 - 153 Gohms
  - Bolt-up #3 - 81.8 GOhms



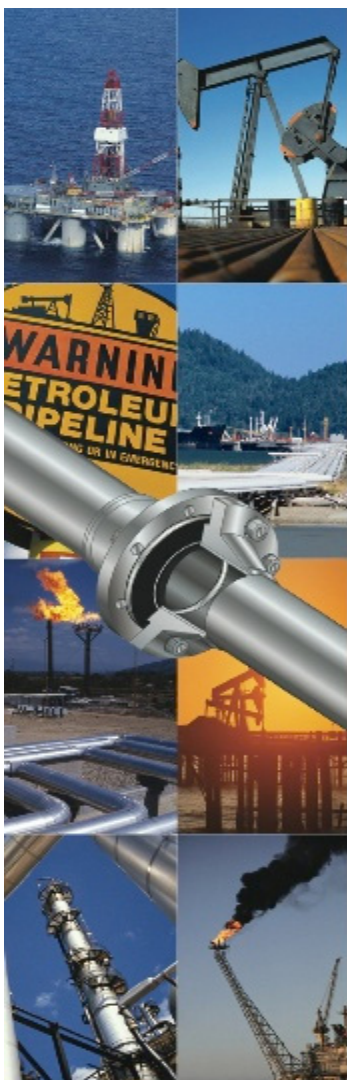
## HCS Testing Conclusion

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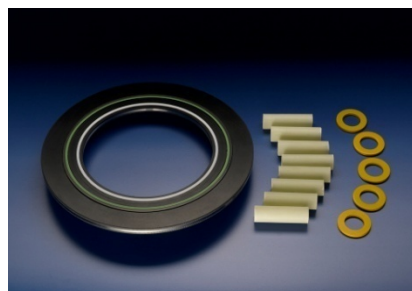
- Both Single and Dual HCS washers maintain very high levels of electrical isolation even after multiple bolt-ups.
- General industry practice requires minimum isolation value of 2-3 Mohms
- A single HCS washer per nut will provide more than sufficient electrical resistance.
- However, this configuration is not recommended due to lack of redundancy and isolation degradation seen in subsequent bolt-ups.



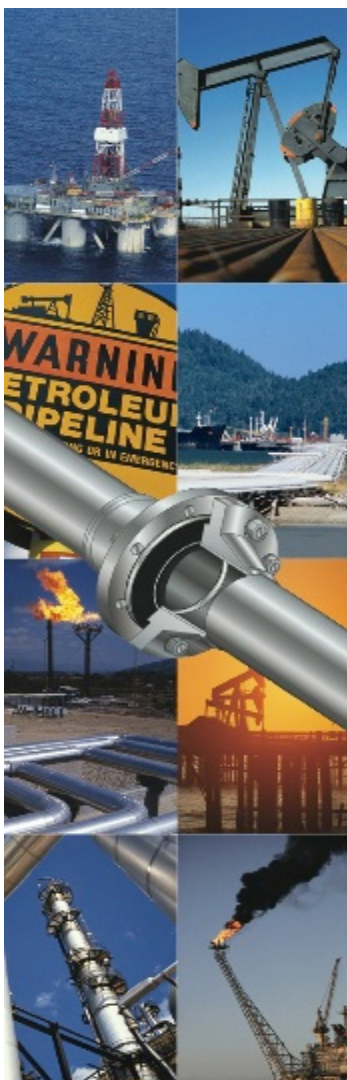


## The HCS Washer

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- High Resistivity Isolating System
- Eliminates potential crushing of GRE Isolating Washers
- High Visibility Yellow
- Can be specified with standard VCS Gasket System

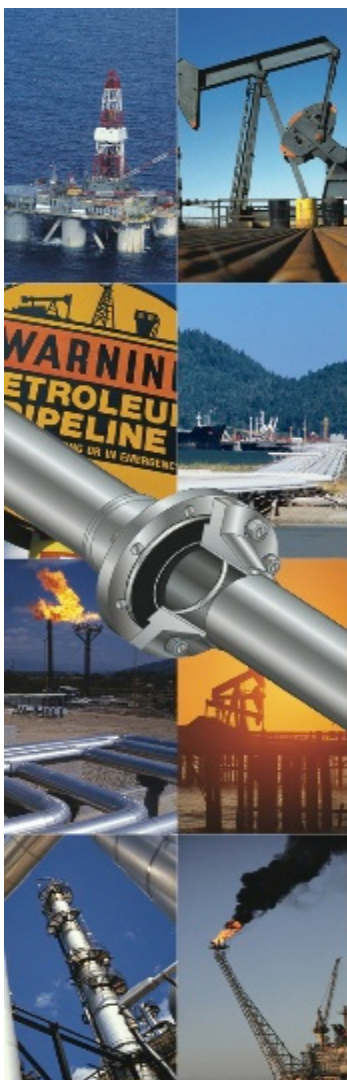


## Conclusion

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- The First FireSafe Electrical Isolation Gasket System Provides Superior Sealing and Electrical Isolation with the Fire Safety of a Metal Gasket
- Maintains complete commonality with field proven VCS – no additional qualification needed
- Specify Isolation Gaskets must be API 6FB Qualified
  - Note: API 607 Fire Test is low pressure
- High Strength HCS Washers can be specified with standard VCS



- 
- Thank you
  - Questions?

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