GASKET DESIGN & BOLTING

Presenter Syed Arif
Applications Engineer

Sheration Brookhollow – Houston, TX
Lamons Capabilities

- Fastener Manufacturing
- Kammpro Manufacturing
- Soft Gasket Manufacturing
- Heat Exchanger Manufacturing
- Spiral Wound Manufacturing
- Fastener Manufacturing
- API Manufacturing
Why is there so many different kinds of Gaskets???

There are so many different type of applications that require to customize gaskets in order to seal that application.
Gaskets Vary on the Operating Conditions

Gasket are designed to suit for the different operating conditions:

<table>
<thead>
<tr>
<th>Internal Pressure</th>
<th>Operating Temperature</th>
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<tbody>
<tr>
<td></td>
<td>DANGER HIGH PRESSURE</td>
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<tr>
<td></td>
<td></td>
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<tr>
<td>Process/Media in the line</td>
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</table>
GASKET DESIGN BASED ON INTERNAL PRESSURE

- SOFT GASKETS
- SEMI-METALLIC
- METALLIC

INTERNAL PRESSURE
Soft/Sheet

GASKET
SOFT GASKETS BASED ON INTERNAL PRESSURE

ELASTOMERS

CNAF

PTFE MATRIX / GRAPHITE

INTERNAL PRESSURE
Description:
L-100 is a high performance biaxally orientated PTFE gasket material with the addition of a **High Quality Silica filler system**.

Applications:
L-100 can be used to seal most chemicals except molten alkali metals, fluorine gas and hydrogen fluoride. Please refer to Matrix chemical resistance data. L-100 is approved for potable water service, complies with requirements of FDA regulations and **can be used at all concentrations of Sulfuric Acid**.

Approvals:
Complies with the requirements of FDA21 CFR 177.1550
Test information is available for: ROTT, BAM for Oxygen

Matrix L-100 Thickness Range:
1/32” (0.8mm) to 1/4” (6.4mm)
Description:
L-104 is a superior performance biaxally orientated PTFE gasket material with the addition of Hollow Glass Microspheres.

Applications:
L-104 can be used to seal most chemicals except molten alkali metals, fluorine gas and hydrogen fluoride. Please refer to Matrix chemical resistance data. L-104 is approved for potable water service, complies with requirements of FDA regulations and has exceptional compression characteristics making it ideal for glass lined flanges or where loading problems exist.

Approvals:
Complies with the requirements of FDA21 CFR 177.1550
Test information is available for: ROTT

Matrix L-104 Thickness Range:
1/32” (0.8mm) to 1/4” (6.4mm)
L-104 Gasket

Glass Bubbles

Before the gasket is loaded the glass bubbles are spherical
After the gasket is compressed the glass bubbles become an ellipse. The presence of load flexes the glass bubbles.
If there is any relaxation in the flanges / fasteners then L-104 will recover to maintain the seal. This is possible because the glass bubbles recover back into their original spherical shape.
Description:
L-110 is a superior performance biaxally orientated PTFE gasket material with the addition of a Barium Sulphate filler system.

Applications:
L-110 is used in sealing food, pharmaceuticals and other chemical media, please refer to Matrix chemical resistance data. The material complies with the requirements of FDA regulations and is acceptable for use in aqueous hydrofluoric acid below 49%, but is not suitable for sealing molten alkali metals or fluorine gas.

Approvals:
Complies with the requirements of FDA21 CFR 177.1550, TA-LUFT
Test information is available for: HOBT, ROTT, EN 13555, BAM for Oxygen

Matrix L-110 Thickness Range:
1/32” (0.8mm) to 1/4” (6.4mm)
FRP Flanges

- Fragile flanges can crack with high loads
- Require low bolting
- Require softer gaskets to seal
NEW! Corrugated PTFE Gaskets - CPG

Advantages:
- Minimum Temperature: -450F (-268oC).
- Maximum Temperature: 500F (260oC).
- Maximum Pressure: 1235 psi (85 Bar)
- Sizing to meet ASME B16.5 and special flanges
- Complies with the requirements of FDA21 CFR 177.1550.
- Test information is available for: HOBT, ROTT, EN 13555.

Matrix CPG® is ideal for glass lined, plastic and FRP flanges where high gasket stress are not possible.

Patent Pending
GASKET DESIGN BASED ON INTERNAL PRESSURE

- SOFT GASKETS
- SEMI-METALLIC
- METALLIC

INTERNAL PRESSURE
Spiral Wound GASKET
Gasket Constant

“M” - 3

“Y” - 10,000 PSI (Minimum Stress)

Windings can only handle maximum stress of 40,000 PSI
KAMMPROFILE

GASKET
Kammpro Gasket Features

Advantages:

- Soft sealing faces
- Flexible graphite facing material
- Serrated metal core
- Wide range of metal cores
- Sizing to accommodate application

- Minimum Gasket Stress:
  - Lower M & Y factors
  - \( M = 2.75 \)
  - \( Y = 3,700 \text{ PSI} = 3700 \text{ PSI (Minimum Stress)} \)
  - Core can handle a \textbf{maximum stress of 60,000 PSI}
<table>
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<tr>
<th>Styles</th>
<th>Typical Applications</th>
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<tr>
<td><strong>LP-1</strong></td>
<td>Heat Exchangers</td>
</tr>
<tr>
<td><strong>LP-2</strong></td>
<td>Class 150 - 2500lb Standard Pipe</td>
</tr>
<tr>
<td><strong>LP-3</strong></td>
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Lamons Kammpro Milling Technology

- Cutting Tool is specifically designed to accurately achieve desired geometry
- All serrations are cut simultaneously and on the same fixed plane
- The height of the core and cutting tool is constant during the cutting phase
- The height of the table is the only adjustment required for operator, which minimizes potential for error
Non-Circular Shapes

- Unprecedented Kammprofile Technology
- Specific to Lamons’ Kammpro Milling Process
- Eliminated Buckling and Winding deformation on elliptical manways and handhole spirals
Like how Spiral wound thickness is a control crushed we can customize the Kammprofile gasket thickness as needed.
HIGH TEMPERATURE GASKET - HTG
Oxygen Attack at Elevated Temperatures on a Spiral Wound Gasket

- Graphite usually goes from 850 F to 975 F but what about applications higher than 975 F?
Advantages:

• combines the corrosion and oxidation resistance of Mica and Flexible Graphite.

• The Mica acts as a barrier on the OD and ID to protect graphite oxidation.
Lamons Kammpro-HTG

Kammprofile facing (oxidation inhibited flexible graphite with mica phyllosilicate based shielding)

Flexible graphite is protected from oxidation by mica phyllosilicate based oxidation shielding.
Alkylation Process

- A refining process used to enhance gasoline octane ratings

- Inherent in several of these process systems is the use of (HF) hydrofluoric acid as a catalyst
Lamons WRI-LP Gasket

- Faced/filled with flexible graphite or PTFE covering layers

- PTFE is rigidly bonded and completely encapsulating carbon steel inner ring (can also be Monel for critical service)

- Machined serrations create “point contact” loading

- Basic spiral wound design is consistent with standard design practice
Advantages:
- Supreme corrosion protection to the bore
- Fire Safe Design
- Low loading requirements
THERMAL CYCLING

APPLICATIONS
Advantages:

- High sealing ability
- Maintains high bolt loads in HE when retightened
- Choice of metal and facing material
- Sizing to meet ASME B16.5 and special flanges
- Minimum Gasket Stress:
  - Lower M & Y factors
  - $M = 2.75$
  - $Y = 3,700$ PSI
CorruKamm™

- Maximum recovery from joint assembly relaxation
- Able to deflect and compress under load
- Maximum stability, resiliency, deflection and conformance
- Heavy machined core
- Ideal for Heat Exchanger vessels, reactors or standard flanges where thermo cycling is present

- M - 2.75
- Y - 3700psi
CONVERSION
RTJ to RF GASKET
Mating a RF to RTJ assembly

Lamons Style WRI-RJ

Lamons Kammpro Adapter
Lamons Kammpro RTJ/RF Adapter
WRI-RJ
(RTJ to RF connection)
Lamons Kammpro-ORJ and Kamm-PEG

- Based on Octagonal standard shape and completely compatible with standard flanges
- Creates a tight fugitive emissions seal on troublesome applications
- Adds surface conformity and forgiveness in regards to surface finish imperfections
- Helps protect flange facing
- Can be cleaned and reused
Dual Seal Kammpro®
RFID TAGS
HIGH TECH TAGGING
What is RFID?

- **RADIO FREQUENCY IDENTIFICATION**
IGT – Intelligent Gasket Tagging

- Read Information Electrically Via Tag On Flange
- Use Tags on Hot Equipment up to 1000 F.
- Read tags about 25 ft away depending on the reader
- All UHF Gen2 RFID guns are compatible to read tag
Snap-On Metal and G10 Washers

• Easy Install
• No need to effect clamp load
• Strong gripping and locking ability
Cathodic Protection

Gasket Isolation
Cathodic Protection

Dissimilar Metals – Galvanic Corrosion

Stainless steel valve

Carbon steel piping
What are Isolation Products?
Types of Isolation Gaskets

- Phenolic RTJ
- Compressed Sheet
- Rubber Faced Phenolic
- Incline Plane Composite
- Spring Energized Steel Core
Defender™ FS - FireSafe

- Two integral robust sealing elements for sealing and isolating in an engineered Fire Safe design.
- Tested and Certified to API 6FP (Third Edition).
- Incorporates industry proven Kammpro® sealing technology.
- Serves as a sealing/isolation for Fire Safe Applications.
Defender™ – Steel Core

- Tested to Shell Certification Standards
- Spring energized seal element
- Isolating Material
  - Proven design based on the industry leader
- 0.250" (6.35mm) Thick
- 316 Stainless Steel Metal Core
- Teflon® Sealing Element with Stainless Steel Spring
- Press-n-Lock “Glue-Less Seal Groove Technology”. An industry first!
The Evolution of the LAMONS LP1 FIN FAN Plug
GENERATION 1
STANDARD FIN FAN PLUG & GASKET

FIN FAN GASKET

FIN FAN PLUG
GENERATION 2
LAMONS LP1 FIN FAN PLUG & GASKET

FIN FAN GASKET
LAMONS LP1 G9 Gasket
Flexible Graphite Facing
GENERATION 3
LAMONS FIN FAN PLUG & GASKET

- LP1 Substrate built into FIN FAN plug for less chance of any leak
Bolting & Lubrication
Premium Lubricants

- **Nickel 328**
  - Up to 2000°F
  - Nut factor = 0.14

- **Moly-B**
  - Up to 1500°F
  - Nut factor = 0.13

- **Arctic Grade**
  - -30°F to 450°F
  - Nut factor = 0.15

- **GP-450**
  - Up to 450°F
  - Nut factor = 0.17
  - Economical
## Torque Value Using No Lubrication

<table>
<thead>
<tr>
<th>Calculation Type</th>
<th>Assem(1), Oper(2)</th>
<th>1</th>
</tr>
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<tbody>
<tr>
<td>Gasket Type</td>
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<tr>
<td>Gasket Sealing Surface OD (in)</td>
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<td>Additional Load (lbs)</td>
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<td>Internal Pressure (psi)</td>
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<td>Number of Stud Bolts</td>
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<tr>
<td>Stud Bolt Diameter (in)</td>
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<td>Stud Bolt Stress (psi)</td>
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<tr>
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<td>Hydrostatic End Force (lbs)</td>
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<td>Bolt Root Area (in²)</td>
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## TORQUE VALUE USING GP-450 LUBRICATION

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[Image: LAMONSS_sealing_global.png]
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Importance of Lubrication

2" - B7 Studs
Torqued to 50% Yield

- No Lubricant
- Moly Lube on Threads Only
- Moly Lube on Face Only
- Moly Lube on Thread and Face

Torque (ft./lbs.)
Hooke’s Law

Extension is proportional to the applied load.

- **Load**
- **Extension**
- **Yield Point**
- **Ultimate Strength**
- **Failure**

**Target Load**

**Resulting Elastic Extension**

**Applied Bolt Load**
SPC4™ LOAD INDICATING SYSTEM
Despite many factors that comprise the complexity of bolted joints, performance can be simplified by concentrating on the **Clamp Load**

All these factors impact on **Clamp Load**

The most effective means to ensure bolted joint performance is to target and maintain, accurate and uniform **Clamp Load**
Non-Integral Systems for Determining Bolt Elongation

**Strain Gauges**
- Incorporates a bonded device that is wired to a digital readout
- Reports tension in the fastener through electrical resistance
- Requires a high degree of operator expertise
- Not well suited for a field environment
- Must be reassembled to monitor load once placed in service

**Ultrasonic**
- Incorporates an acoustic coupling device that uses a pulse-echo technique
- Measures time of flight of the loaded fastener and compares it to that of the unloaded condition to give elongation
- Coupled to an electronic device capable of converting the pulse echo time of flights to load
- Requires a high degree of operator expertise
- Must be reassembled to monitor load once placed in service
Applications

Pump Application

Transmission Coupling

Where uniformity of clamp load is essential…
Principles of Operation

- Calibrated ASTM 0.2% Yield Strength Load
- Displacement is a direct measure of applied load
- Linear scale (within yield point)
- Bolt is now calibrated (±6% target load)
Rotating Flange Application

Leaking slurry and flange separation resulted in reoccurring bolt failures.
Applications
R1 Reactor Nozzle (14” 1500, R- Recommended Loading of 50ksi 63 347 SS Ring)
Heat exchanger EA-1703 leaked following plant trip
Load is now monitored and leakage has been prevented
The three balls mounted in the washer are thicker than it, & protrude slightly on each of its sides. The balls embed into the flange or the THSW and keep the nut from turning.

The washer is placed between the nut and the flange or between the nut and a through-hardened steel washer (THSW).

During tightening, the nut and Ball Lock Washer are forced against the flange.
Ball Lock Washers

- Apply Moly B here ONLY!
- DO NOT APPLY TO WASHERS OR NUT!
- MOLY B ON ALL SURFACES, THIS SIDE ONLY
Fingersaver

Advantages:

- Safety is the first concern in any facility
- Protect your hands away from the impact of a hammer

Two Lengths available 14 ¾” (37.46 cm) and 33 ½” (85.09 cm)
Questions?

Contact Lamons Technical Department:

TOLL FREE: 1 (800) 231-6906
EMAIL: engineering@lamons.com

Presenting Engineers:
Application Engineer Syed.Arif@lamons.com