



**JOHNSTOWN SPECIALTY
CASTINGS INC.**

Johnstown LORAIN® Liners

A Subsidiary of WHEMCO

545 CENTRAL AVENUE
JOHNSTOWN PA. 15902
(814) 535-9019

**INFORMATIONAL PACKET
CEMENT PLANT**



Johnstown Specialty Castings, Inc.

LORAIN® LINERS

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JOHNSTOWN SPECIALTY CASTINGS INC.

Johnstown LORAIN® Liners

545 CENTRAL AVENUE

814-535-9019

JOHNSTOWN PA. 15902

A Subsidiary of WHEMCO, Inc.

Attention: Mill Manager

Subject: LORAIN® Hot Rolled Steel Shell Lining for Horizontal Cement Mills

If you operate Allis Chalmers, F.L. Smidth, Nordberg, Polysius, or Kennedy Van Suan (K.V.S.) Ball/Rod Mills, let us take this opportunity to introduce you to Johnstown LORAIN® Liners. We make the only Hot Rolled Steel Shell-Liner in the world, while everyone else makes a Cast-Liner.

Our Type "A" Liner has been used for many years in Finish Mills (second compartments), in Coal Mills at Cement Plants. Our type "A" Liner in the second compartment of a Finish Mill will give equal to, if not greater production than a Cast Classifying Liner.

A study conducted by the Fuller Co. (F.L. Smidth), established that If your Mill utilizes a High Efficiency Separator (H.E.S.), our "A" Liner in the second compartment will out produce and out wear a Classifying Liner. Given the testimonials from our current customer base, along with the increase of production and the throughput tonnage, longevity is increased on average about 2:1 compared to the Classifying Liners wear life.

Our type "D" Liner is used in Raw Mills, and first compartments of Finish Mills. The type "D" Liner by far is our strongest Lining offered, given its unique chemistry, it will outlast any Cast Liner, as well as outperform it. We guarantee zero breakage and offer full replacement of any affected portion of our liner.

The lift design of our Lining will increase your production. Given our lift characteristics, our Lining wears at a rate that maintains your desired lift for the entire life of our Lining.

We have been making the LORAIN® Liner since the 1960's. We developed this form of Liner when we were owned by U.S. Steel Corporation, in conjunction with Fuller (F.L. Smidth) and Allis Chalmers (METSO), operating as Johnstown Works of U.S. Steel Corporation. Both the Lift Bar, and the Liner Plate have their own individual chemistries that gives us the advantage over any Cast-Liners.

Please contact us if you are interested in discussing LORAIN® Hot Rolled Steel Shell Liners. A list of satisfied customers, who you may want to contact, is available upon request.

Best Regards,

Mark A. Stahl Plant/Operations Manager

Attachments:

Johnstown LORAIN® Hot Rolled Steel Mill-Liner Informational Packet.



Lorain® Linings



Type "A" Lorain® Lining



Type "B" Lorain® Lining

There is only one manufacturer of "Lorain" Rolled Steel Linings in the world - "Johnstown Specialty Castings, Inc."

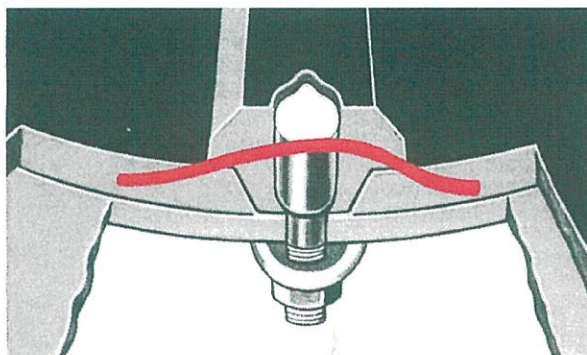
If it is a Lorain® Lining it's:

- Hot rolled to finish shape, 3:1 Reduction
- Vacuum degassed alloy steel
- Rolled Steel offers tighter grain structure and more integrity than castings
- Geometrically designed for the most efficient cascading action
- Two-piece, dissimilar metals allows for uniform wear on bar and plate. This in turn maintains a lift height for the entire lining campaign.
- "Through" hardened by oil quenching and tempering
- Machined to length
- Machined for exact bolt hole positioning
- 100% automated magnaglo inspected

The advantages of Johnstown Specialty Castings, Inc. Rolled Steel Lorain® Linings are:

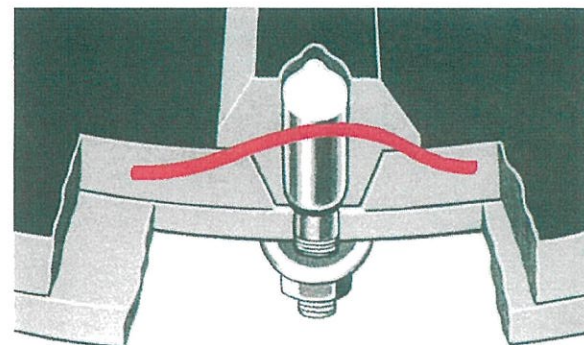
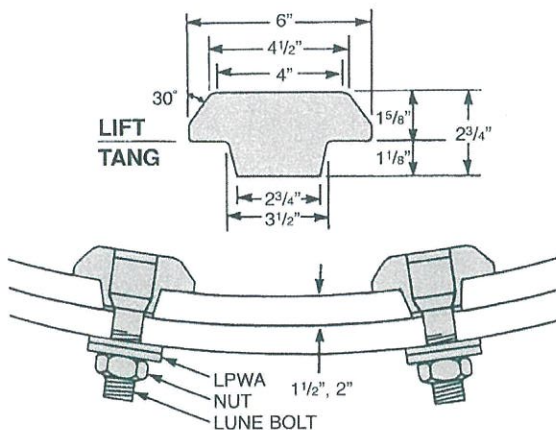
- Lower cost per ton of grind due to extended liner life
- Lower cost per ton of grind due to grinding efficiency
- Lower cost per ton of grind due to reduced liner breakage
- Lower cost per ton of grind due to ease of installation
- Lower cost per ton of grind due to elimination of zinc or rubber backing

The "Lorain" Rolled Steel Lining is a grinding system that has evolved over the past 80 years at Johnstown. It has and continues to be the industry benchmark for grinding performance.



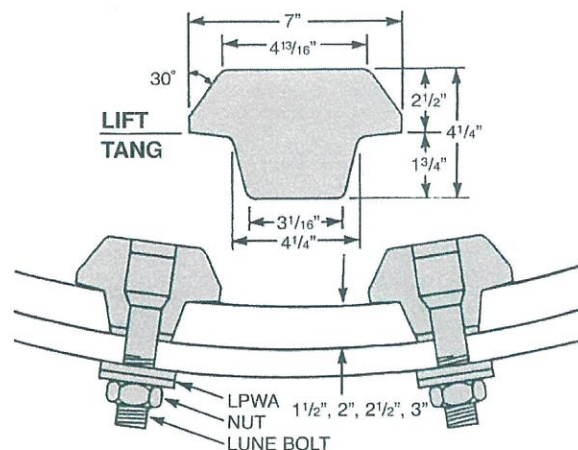
...consists of lift bar section M-3715A used with 1½", or 2" thick liner plates. This type of lining with the lightweight lift bar section (41.9lbs./ft.) is most suitable for cement clinker, coal, and other soft grinding jobs. Maximum lift height is 1⅝". (Curved line above indicates maximum wear pattern.)

The Type "A" Lining is the lightest manufactured by Johnstown Specialty Castings Inc., and is most suitable for dry-grind ball mills where grinding media is 2" diameter or less. A typical example is the last compartment of multi-compartment mills used to finish-grind cement. (Shown below are dimensions and cross sections.)



...consists of lift bar section M-3714A used with 1½", 2", 2½", or 3" thick liner plates. Maximum lift height is 2½". (Curved line above indicates maximum wear pattern.)

The Type "B" Lining has a heavier lift bar section (73.5 lbs./ft.) than Type "A", which increases service life, and is applicable to mills where increased lining life is desired. Typical uses would be in dry-grind rod and ball mills where the grinding media is 3" in diameter or less. (Shown below are dimensions and cross sections.)





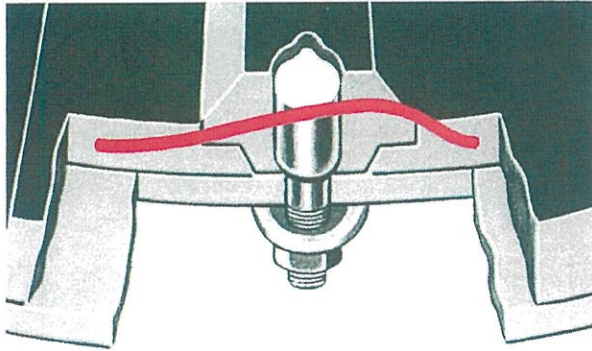
Type "C" Lorain® Lining



Type "D" Lorain® Lining

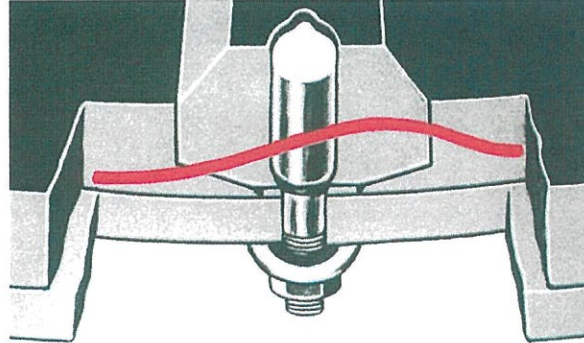
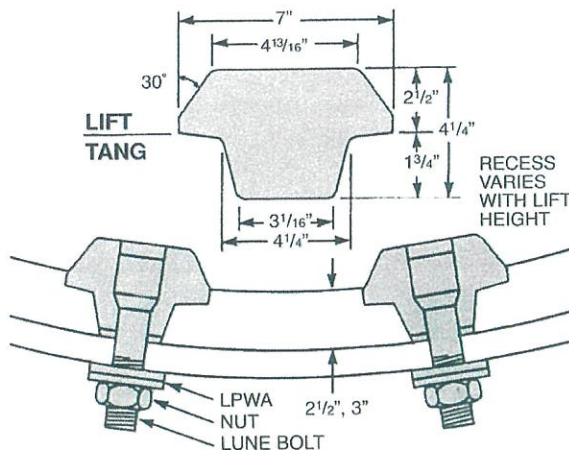


Mill Liner Fastening System



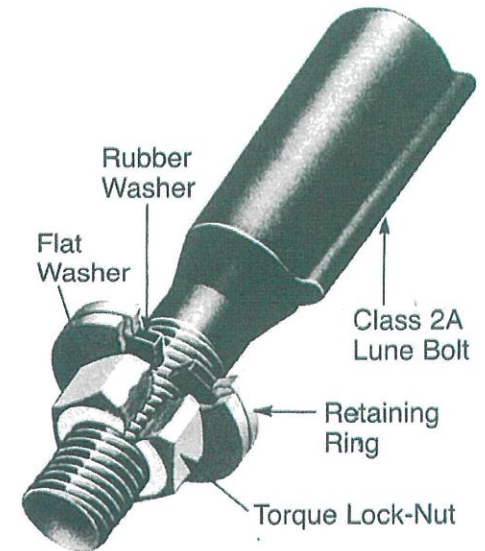
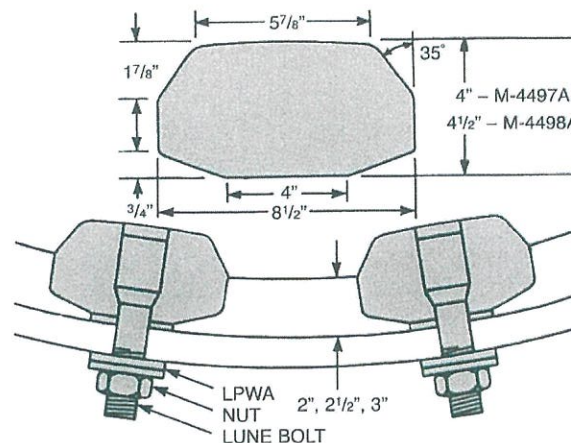
...differs from Type "A" and Type "B" in that the lift bar sections are recessed into the plate. Recessing in this type of lining offers: (1) increased bar life through protection of its leading edge; (2) relief of strain on bolts by transferring impact from lift bars to liner plates; and (3) reduction of effective lift height when desired or dictated by the speed of the mill. (Solid, curved line above indicates wear pattern.)

This lining is available with lift bar sections M-3715A or M-3714A that fit into recesses ranging from $\frac{3}{8}$ " to $\frac{3}{4}$ ", depending upon lift height requirements, with plate thicknesses of 2", 2 $\frac{1}{2}$ ", and 3". Maximum lift height is 2 $\frac{1}{8}$ ". Typical uses would be in wet-grind rod and ball mills using larger diameter grinding media. (Shown below are dimensions and cross sections.)



...is a heavy duty lining consisting of lift bar sections M-4497A (100.7 lbs./ft.) or M-4498A (114.6 lbs./ft.), used with 2", 2 $\frac{1}{2}$ ", or 3" thick liner plates. Maximum lift height is 2 $\frac{1}{8}$ ". Different lift heights can be obtained for a variety of grinding conditions by using different combinations of liner plates and lift bars.

The Type "D" Liner offers marked reductions in grinding costs through increased service life. (Curved line above indicates maximum wear patterns.) This type of lining is recommended for use in rod and bar mills where grinding conditions are unusually severe, or where extra-long lining life is desired. (Shown below are dimensions and cross sections.)

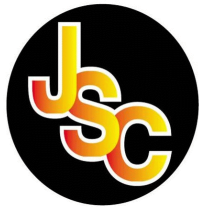


...consists of a threaded Class 2A lune bolt, torque lock nut, retaining ring, rubber washer and flat washer. This fastener system is available in diameters from 1" to 1 $\frac{3}{4}$ ". To accommodate the differences in lift bar or liner plate thicknesses, in current use, lune bolts are available in various head lengths from 1 $\frac{1}{2}$ " to 5 $\frac{1}{4}$ ". They are designed with UNC-2A standard coarse threads for use with Grade B lock-nuts.

The lune bolt fastener system is easy to install, and provides a reliable system to prevent leakage.

Recommended Torque Values

| Diameter, in. | Ft.-lb. min. |
|-----------------|--------------|
| 1 | 600 FP |
| 1 $\frac{1}{4}$ | 1,250 FP |
| 1 $\frac{1}{2}$ | 2,300 FP |
| 1 $\frac{3}{4}$ | 4,100 FP |

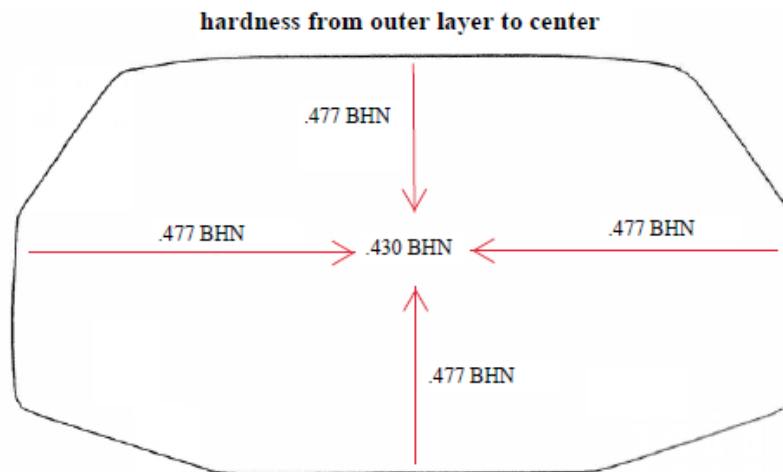


Johnstown Specialty Castings, Inc.

LORAIN® LINERS

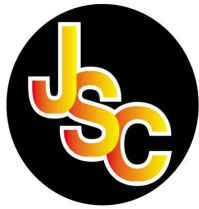
Lifter Bar Stock
M4497A and M4498A
Type - "D" Lining

| Chemical Compound | Weight Percent |
|-------------------|----------------|
| Carbon | .56 - .62 |
| Manganese | 1.50 - 1.70 |
| Phosphorus | .040 MAX |
| Sulfur | .040 MAX |
| Silicon | .65 - .85 |
| Chromium | .65 - .95 |
| Molybdenum | .19 - .24 |



BHN = Brinell Hardness Number

The Hot Rolled type "D" Lift Bars are produced using the above chemistry, and are Hot Rolled to a 3 to 1 Reduction Ratio. This ensures a tight grain (molecular) structure, making the Lift Bars strong and resilient. The hardness is consistent throughout the Lift Bar. This leads to our superior wear life compared to Cast Liners. There is no breakage.



Johnstown Specialty Castings, Inc.

LORAIN® LINERS

Lifter Bar Stock
M3715A
Type - "A" Lining

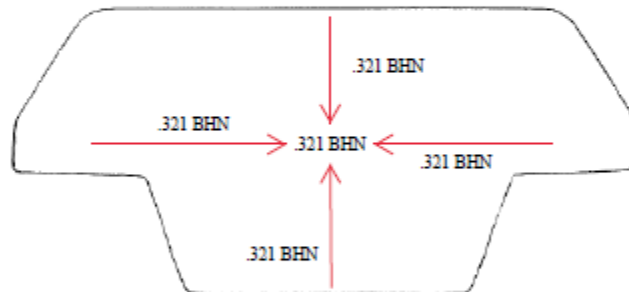
Chemical Compound

Carbon
Manganese
Phosphorus
Sulfur
Silicon
Chromium

Weight Percent

.60 - .70
1.40 - 1.75
.040 MAX
.040 MAX
.40 - .60
.65 - .95

**Diagram: M3715A Lift Bar degree of
hardness from outer layer to center**



BHN = Brinell Hardness Number

The Hot Rolled type "A" Lift Bars are produced using the above chemistry, and are Hot Rolled to a 3 to 1 Reduction Ratio. This ensures a tight grain (molecular) structure, making the Lift Bars strong and resilient. The hardness is consistent throughout the Lift Bar. This leads to our superior wear life compared to Cast Liners. There is no breakage.



Johnstown Specialty Castings, Inc.

LORAIN® LINERS

Liner Plate Stock

RPL-6075

| Chemical Compound | Weight Percent |
|--------------------------|-----------------------|
| Carbon | .56 - .62 |
| Manganese | 1.50 – 1.70 |
| Silicon | .65 - .85 |

This is our very own Liner Plate chemistry (RPL-6075). It was developed for our Hot Rolled process, which is used exclusively for all ' LORAIN® LINERS' products. The Liner Plate stock is rolled to a minimum reduction rate of 10 to 1, and a maximum reduction rate of 19.97 to 1, leaving very limited porosity. Our unique Liner Plate chemistry is designed so that the plate wears at a specific rate to maintain the original lift height in conjunction with our Lift Bars, which also have a unique chemistry dependent on which one of our liners you choose to utilize (M3715A Lift Bar for type - A Liner, or M4498A for type - D Liner). The Liner Plate and Lift Bar chemistries ensure that THE LIFT HEIGHT WILL REMAIN CONSISTENT FOR THE ENTIRE LIFE OF THE LINING.



Johnstown Specialty Castings, Inc.

LORAIN® LINERS

Johnstown LORAIN® Rolled Steel Plate Lining

- Johnstown LORAIN® Mill Liners give a superior service life, and highly efficient grinding action at a lower cost per-ton of production.
- Johnstown LORAIN® Mill Liners are made from a special Hot Rolled Heat Treated alloy steel which provide higher strength, plus better impact, and wear resistance, than cast liners.
- Through Hot Rolling, better physical properties and metallurgical structure is achieved. These superior properties payoff in extended wear life, while provide maximum grinding proficiency and eliminating costly breakage and premature replacement during operation.
- Johnstown LORAIN® Mill Liners are a two-piece lining system, consisting of Liner Plate sections and Lift Bars. The plates are Hot Formed to fit the exact curvature of the Mill Shell. As a result, no form of backing is required, eliminating backing material and insulation costs.
- Johnstown LORAIN® Mill Liners are designed to provide a uniformed wear rate throughout its life cycle. This allows optimum cascading action of grinding media during the entire lifespan, ensuring efficient output.

- Johnstown LORAIN® Mill Liners are a fabricated product from burning and machining of the Liner Plates, to the machine drilled holes in the Lift Bars.

This, plus other quality control procedures assure no oversize gaps to the shell. A more precise fit, which leads to a significantly easier installation. This workmanship eliminates costly corrective actions during the installation.

- All Heat-Treated Johnstown LORAIN® Lift Bars are 100 percent magnetic particle inspected to ensure against cracking and spalling through the life of the liner.

Johnstown LORAIN® Mill Liners.

- Johnstown LORAIN® Liners prides itself on its efficient Lead Times. Typically, we can complete and ship an entire Liner within 8 to 20 weeks. If material is on hand, 8 to 10 weeks.
- Finally, Johnstown LORAIN® Liners, offers a full warranty on breakage. The requirement for costly spare Liner parts is eliminated.