



CTI-X7® Ceramic Process Equipment

Applying Ceramic Standards to Target
Improved Operational Performance

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1979 -1982



Preface

Early on in my career, I worked with world class craftspeople, welder fitters, mechanics, and foremen. My best memories include putting trains back on track; replacing chutes, pipes and cyclones; and changing out broken vibrator decks - all dangerous situations where a wrong move could result in a serious injury or death. When we were operating on break down situations, it came down to one split decision to get it right. We took pride in that team work.

When we came together as a team, it was a sight to see. Our performance relied on dealing with the immediate problem, whether it was to restore the feeds, or get back on coal to get the plant processing or the mine running. We were in sync. Many times, it was signals as subtle as a frown or fulfilling as a smile from the boss man or lead mechanics. The young foremen were judged daily and we felt the pressure to learn and perform. As other young men and women were starting their professional careers, we were taught to concentrate on improved performance.

I was mesmerized by the focus of these teams, applying their trades to keep production running. Over the years, I appreciated that attitude - that in just about every situation, talent shined through over politics. That brotherhood was prized highly from generation to generation and has stood the test of time. Looking back, I still smile remembering when our guys would change shifts, coming across the railroad tracks after a safe shift, with black, sweaty faces and their big smiles. They felt good about all of their hard work and were happy to be going home to their families.

While I loved the energy and coal production, I felt times changing. What I've learned still applies many years later: performance counts far more than slogans or operational culture. Anyone involved in operations knows the specific areas that continuously wear out in days or 6-12 month patterns. When this happens, operational mechanics and maintenance teams have to replace and rebuild on a regular basis.

This redundant approach is delinquent. By not applying solutions that continually improve performance, we fall prey to complacent patterns that undermine operational performance. My calling was to build the CTI team to detail solutions utilizing ceramic brick liners for use in steel mills. CTI lined and redesigned a new standard of mining equipment so that 6-8 men could do what had taken 36 men to maintain production.

In my 47 years of experience in mining processes, I have realized that any change in operational procedures can be challenging for all levels of the production team , especially when moving out of the zone of the status quo. Most of the time, they have to see it operate at an improved performance rate to believe in a new process. Continuously improving on production performance counts, and innovative technology is the one true advantage that companies must embrace to track a course of powerful success and results.

"It is not necessary to change, survival is not mandatory." - Dr. W. Edwards Deming

**Lee Osborne
Founder and CEO
Ceramic Technology, Inc.**



Purpose

This paper will objectively define the advantages of equipment redesign based on proven Ceramic Standards (CTI-X7®). Successful implementation of ceramic equipment redesign results in lower operational costs and increased performance, as to pipes 60 ft in the air or a chute or gunnite pressure pot 2 miles down. These benefits are available to primary materials handling systems, limiting repairs for nagging impact and corrosive reaction zones of mining equipment.

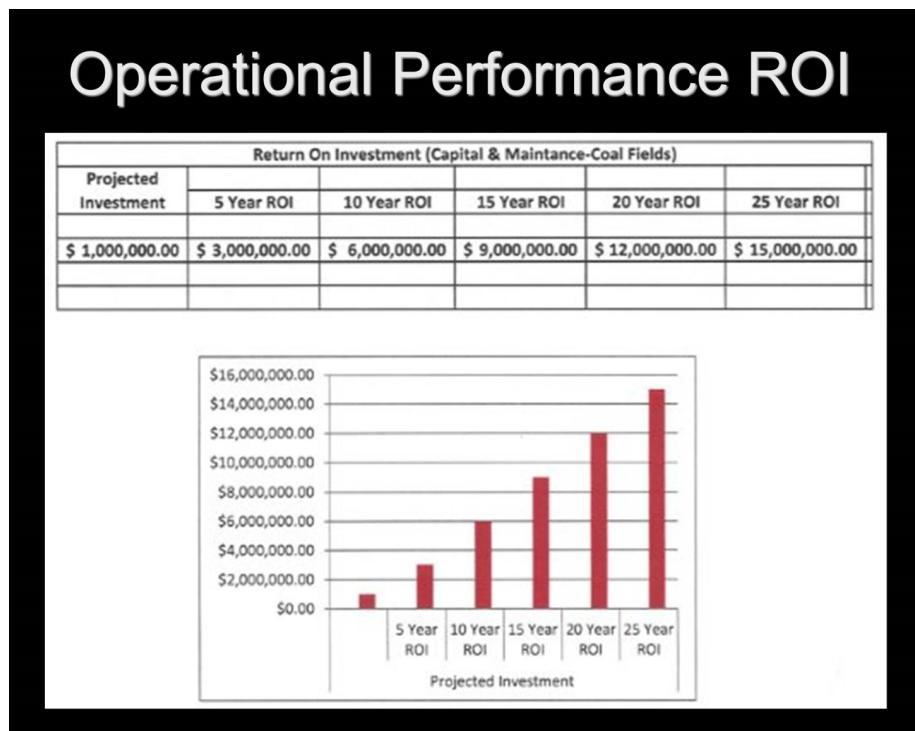
CTI-X7® Capital Equipment:

- Hoppers
- Gravity impact ells
- Pressurized fittings
- Skip Hoists
- Pipes
- Pump lines
- Feed hoppers
- Teeter tanks
- Screen feed assemblies
- Screen pans
- Turn chutes
- Piping systems
- Splitter chutes
- Cyclone assemblies

Ceramic Standards also benchmark improved performance efficiency over traditional liners such as abrasion plates, mild steel chrome overlays, plastics, UHMW, urethanes, rubber, and rubber ceramic matrices. Each equipment application is unique. At the operational level, plant managers must understand different technology selections for every critical application.

We know that annealed pipe will burst when it wears thin, resulting in chemical dumps to the environment, and that hard pipe is very difficult to weld and repair. Rubber lined pipe will gouge rubber when delaminating from pressure of impact, resulting in fragments being caught in pump impellers or cyclones. Welding on rubber lined pipe used in process applications such as gold and phosphate can, and already has created fire hazards.

Ceramic Standard redesign is a path to continuous improvement of maintenance costs. CTI-X7® has proven to deliver 20 to 25 times the ROI of past performance, saving millions for mining companies and coal fired power plants. As The X-7 Ceramic Standards are applied, normal cycles of replacing high-wear process equipment extends from yearly to 5-25 years (depending on whether they are single shifts or 24/7 shifts). Additionally, improved performance is immediate. As maintenance personnel become familiar with improved standards, they become confident that ceramic redesign supports improved operational performance.



Background

With headquarters in Cedar Bluff, Virginia, Ceramic Technology, Inc. (CTI) is a class-A contract manufacturer designing and building high-performance mine processing equipment. CTI is the exclusive manufacturer of CTI-X7® Ceramic Process Equipment and the leading innovator of ceramic liners which prevent operational equipment failure from impact abrasion and reactive wear.

Lee Osborne founded Ceramic Technology, Inc. (CTI) in 1985. Prior to starting CTI, Osborne spent 10 years working in the mining sector as a maintenance and process plant manager. Osborne and the CTI team designed ceramic liners and tested their performance over traditional liners within the mining industry, such as AR400, carbon carbide overlay (CCO), ductile hardened pipes, and rubber or urethane lined pipes.

Osborne's team created the CTI-X7® Brand, and it quickly became a respected performance standard within the mining sector and plant processing industry. The CTI-X7® Brand continues to build a reputation for arriving at the mine site on time and with deadbolt accuracy. We service a wide customer base from Hudson Bay to Tampa Bay, and as far west as Carlsbad, New Mexico up to British Columbia. We are proud of the service performance of our [CTI-X7® Brand and Team](#).



[CTI-X7® Feature in Mine Magazine](#)

<https://bit.ly/2P1eBsJ>

Our team focuses on service reliability and delivering a great return on value. CTI-X7® parts and service continue to realize significant improvements in plant operational performance. Many prominent mining operations across North America today use CTI-X7® designs, with some operating continuously 24/7, as long as 25 years.



Advantages of Equipment Redesign

Most mining plants schedule 24/7 continuous operations and require many hours of labor to do repairs and replacements. However, global health issues and changing work patterns will continue to impact how operations run. With labor shortages and changing work habits, there is a need for more reliability and stability in mining operations. Furthermore, operational costs continue to accelerate for mining companies in North America.

CTI-X7® improves processing equipment standards that limit breakdowns resulting in unscheduled shutdowns. These unexpected events drive up operational costs and increase the need for additional labor to complete a quick turn around or repair. This can put teams in a situation where performance and getting plants back to processing is precarious at best. When applied, CTI-X7® can contribute to as much as a 35% improved use of working hours, improving plant performance while lowering operating costs.

The continued development of ceramics is critical to the mining industry. We work with systems that operate 24/7, mitigating impact abrasion and reactive acids in the 35% solution range. Most process equipment has an average lifespan of 6 months to 1 year due to impact erosion and reactive wear. Proven and tested for over 36 years, CTI-X7® involves the improved redesign of repetitive process equipment, extending operational life from 5 to 25 years on average.

CTI-X7® Process

Aluminum oxide is an industrial composite that is mined as Bauxite, processed, and refined into Al₂O₃. These preprocessed materials are then shipped to porcelain manufacturers as calcined alumina crystals, reacted into the preliminary stage, and compounded.

The crystals are compacted and fired to create liners. They are fired at 2200 degrees in a kiln process that solidifies the tiles through a crystal growth reaction. These tiles sinter to a Mohs hardness index of 9.5, comparable to the diamond hardness of 10. Once the tiles cool, they are packed and shipped to a production facility where our technicians engineer liners to install into CTI-X7® Process Equipment.

CTI specializes in ceramic applications that supply full engineering, detailing, fabrication, and redesign of equipment. Our equipment redesign and replacement targets the maximum life of the plant, usually projected at 20-25 years based on mineral reserves. However, there are mineral process plants we work with that have been operating for 40-45 years.



CTI-X7® Ceramic 33" and 40"

<https://vimeo.com/user22257983/cti-x7/video/80762789>



CTI-X7® CERAMIC PROCESS EQUIPMENT

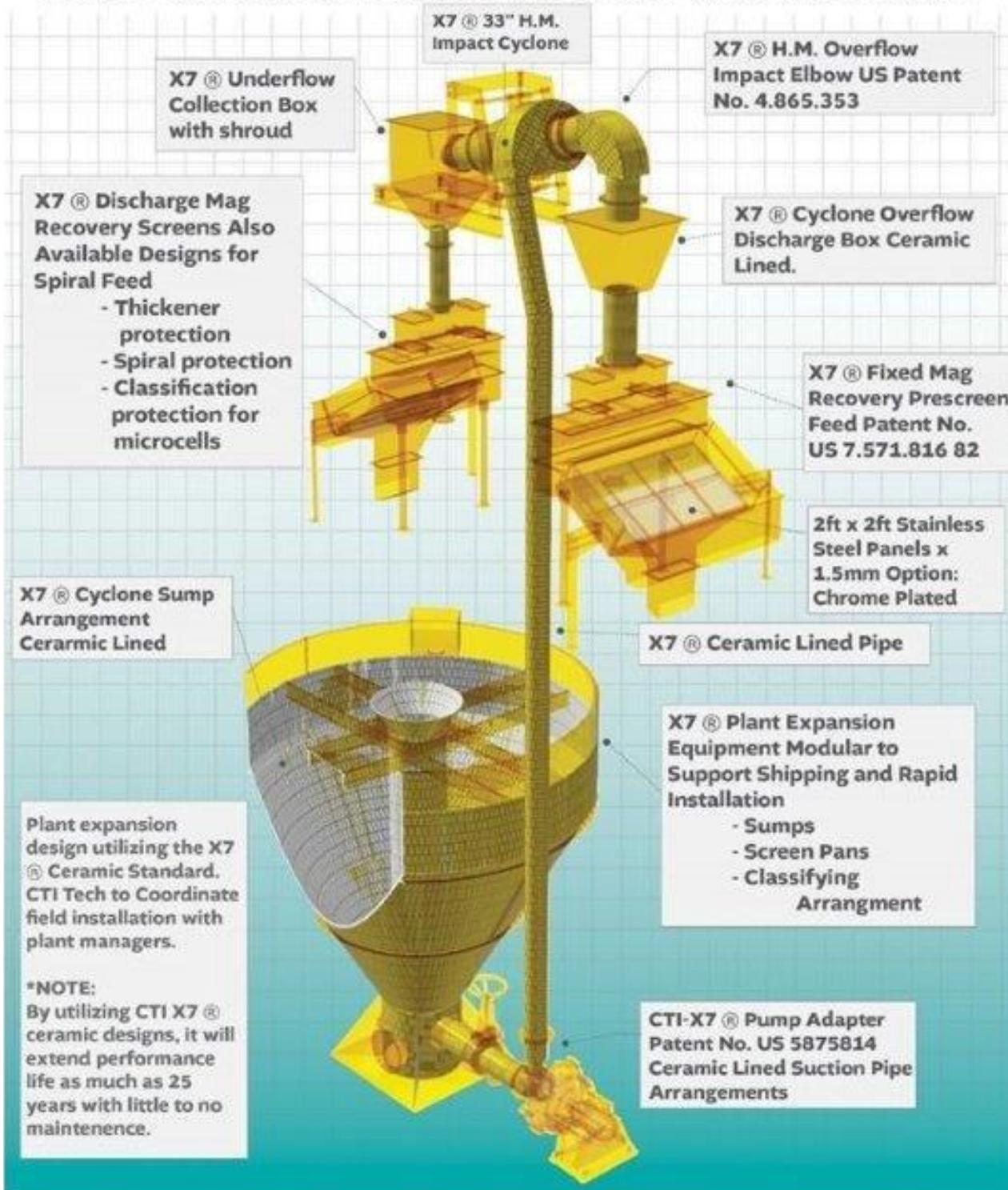
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PLANT EXPANSION DESIGN & CONTRACT MANUFACTURING



Plant expansion design utilizing the X7® Ceramic Standard. CTI Tech to Coordinate field installation with plant managers.

***NOTE:**

By utilizing CTI X7® ceramic designs, it will extend performance life as much as 25 years with little to no maintenance.

CTI-X7® Pump Adapter
Patent No. US 5875814
Ceramic Lined Suction Pipe Arrangements



CTI-X7® Patents & Patents Pending

With the need for greater efficiency and lower processing costs, mining operators continue to shift to ceramic as their primary liners. As more mining companies embrace ceramic linings, CTI continues to research and develop new designs. These improvements focus on ceramic-lined process chutes, cyclones, piping, headers, sumps, and suction lines.

CTI retains patents in the United States, Canada, and Australia. In 2022, CTI added new sensor technology (patent pending) for the CTI-X7® Ceramic Impact Elbow.

US 1,6892,867	June 4, 2019 (Pat Pend.)	CTI-X7® Smart Impact Panel
US 4,775,828	July 21, 2015	TM Logo
US 4,595,389	September 2, 2014	CTI-X7® Ceramic Process Equipment
US 7,571,816, B	August 11, 2009	Adjustable Static Screen (Canada & Australia)
US 865,353	September 12, 1989	Ceramic Impact Elbow



CTI-X7® Applications



**CTI-X7® Ceramic Impact Elbow in
Gold Mining Flows at 40,000 Tonnes per Day (TPD)**
<https://vimeo.com/user22257983/cti-x7/video/81017945>

The picture above is a first-generation CTI-X7® 30-inch Ceramic Impact Elbow that processes 40,000 TPD. This Ceramic Impact Elbow experiences high wear, taking the underflow discharge from 27 separate 33-inch cyclones. Maintenance failures on mining systems of this type can be catastrophic.

In spite of wear, this design has been operating for 6 years. Before the ceramic liner on this equipment, previous rubber liners would fail within 3-6 months. Rubber-lined equipment is notorious for catching fire during repairs, resulting in operational damage and downtime. After the installation of the ceramic liner, operational noise also improved. Mine inspectors typically monitor decibel volume in work areas, and it certainly helps that ceramic liners do not amplify noise. The first prototype is currently being used by Kirkland Lake Gold.

CTI began testing the new second-generation prototype for the Ceramic Impact Elbow on October 15, 2021. This patent pending prototype includes a sensor that transmits real-time information about the ceramic liner's thickness as it experiences wear.

[Sensor Technology for CTI-X7® Ceramic Impact Elbow](#)

<https://vimeopro.com/user22257983/cti-x7>

The sensor will make it easier for plant managers to see the life left in the ceramic lining, allowing them to replace it before spills or other issues occur. Application of this technology targets improved equipment cycles, lower failure rates, and increased tons processed.

This technology will support deep mine and high-volume operations involving cross-country belt transfers, skip hoists, and large volume diameter piping. Oftentimes, this is where system failures happen that result in unscheduled operation shutdowns or environmental spills that affect companies on a large scale.



24-inch and 33-inch CTI-X7® Process Feed Piping

<https://vimeopro.com/user22257983/cti-x7/video/81283534>



References

Ceramic Technology Inc. Website

<https://ceramictech.com/>

CTI-X7® Equipment Videos

<https://vimeopro.com/user22257983/cti-x7>

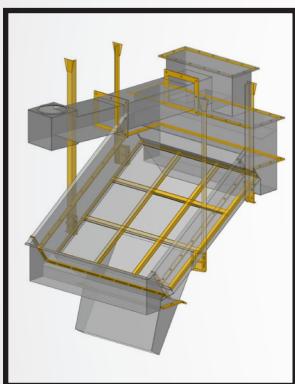
IF WE CAN TURN THIS...



INTO THIS...



JUST IMAGINE WHAT CTI CAN DO FOR YOUR PLANT



CTI X7 SAM-1 PRE-SCREENS



CTI X7 CYCLONES



CTI X7 SUMP SYSTEMS



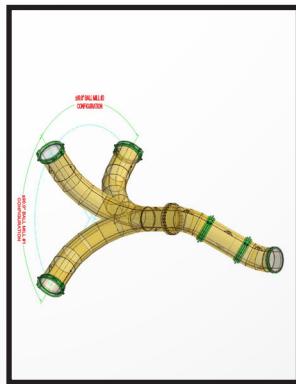
CTI ENGINEERING



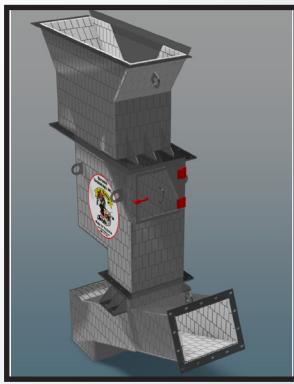
MADE IN VIRGINIA



CTI X7 CYCLONE TUB ASSEMBLIES



CTI X7 PIPING



CTI X7 CHUTE SYSTEMS

CERAMIC TECHNOLOGY, INC. is a world leader in ceramic-lined systems for the process coal and mineral industries. With tough, built-to-last components and an experienced engineering team ready to tackle your design challenges, CTI can increase your plant's efficiency and ROI. Call or visit us online today.

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