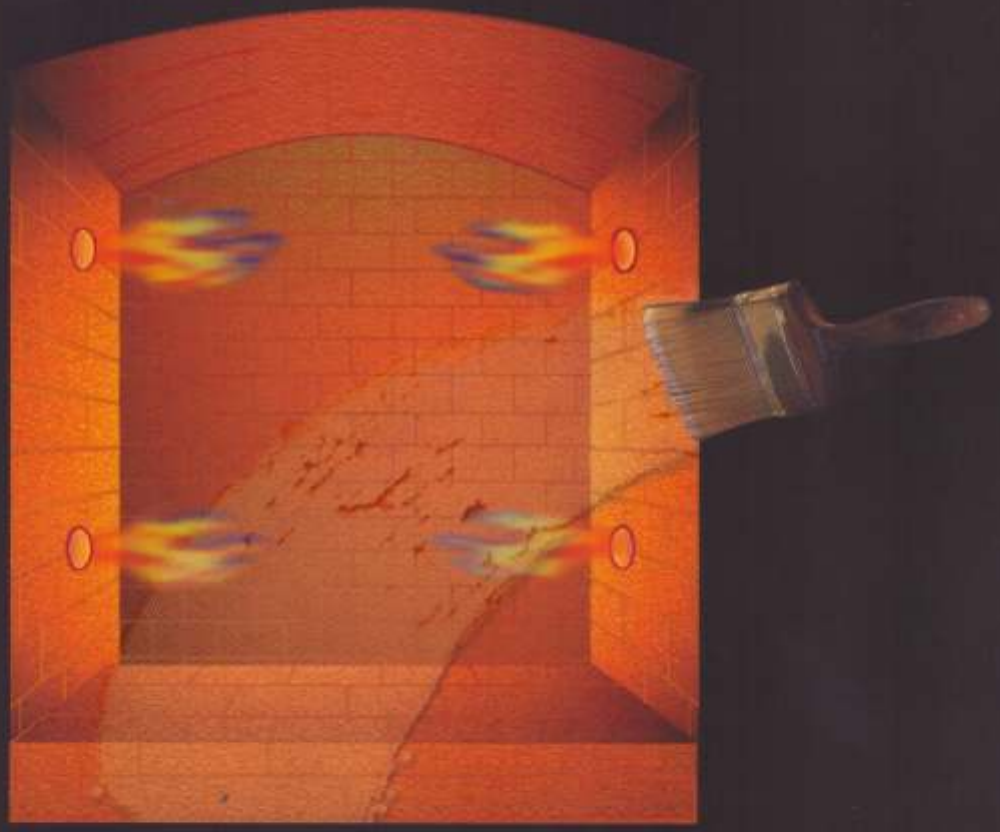
ZIR COAT

The versatile refractory coat with a many faceted role



• PROTECTIVE • LONG-LASTING • ECONOMICAL

JYOTI® CERAMIC

JYOTI

The flame with a global fame

JYOTI®
CERAMIC

There is something exciting about exceeding peoples' expectations. In anticipating their needs and surprising them with products that satisfy them.
We experience this thrill often at Jyoti. As a company, we take pride in bringing to our customers world class industrial ceramics that excel in quality. We look forward to meeting new challenges and converting them into opportunities to better our standards. We are fuelled in our efforts by the trust that our customers have placed in us.

Jyoti is an Indian word, which means a flame and its torch logo symbolises the flame that fires ceramics.

From the President's desk

Jyoti has been manufacturing advanced ceramics of international quality standards since 1970. Over the past 3 decades we have gathered experience as well as expertise in industrial ceramic technology.

Jyoti has established two separate, closely situated, ceramic manufacturing plants in the industrial belt of Nashik town, which is around 180 km. north-east of Mumbai in the state of Maharashtra, India. Each of these plants encompasses over 5000 sq. mtrs. (50,000 sq. ft.) built-up area of modern construction on 4 acres of open land covered with lush green lawns.

Both the plants are equipped with the latest generation production machines which are manned by a professional staff, to bring you products that consistently meet precise performance standards.

Becoming an expert on ceramics does not happen overnight. It takes years of thorough research and development programme and engineering excellence to produce components that can compete effectively in today's global market.

Scanning Electron Microscope

Our ceramic manufacturing facilities are supported by a separate state-of-the-art R&D laboratory and engineering workshop. The R&D Lab is equipped with the latest generation apparatus and pilot production equipments such as SEM, AAS, TG/DTA, XRD, XRF, Sedigraph, Digital Hardness Tester, microprocessor controlled electric and gas fired (1750° C) high temperature lab kilns etc. for testing of incoming raw material and quality control in manufacturing and final products.

Additionally, a separate ceramic body preparation slip house is equipped with a lab size spray drier used for development of newer ceramic bodies.

Looking to our captive needs and the demands from other industries for a suitable erosion-corrosion controlling, high temperature-resistant refractory coating, we initiated development of a suitable refractory coating possessing all the required features. Finally we succeeded in developing a unique refractory coating compound, called Zircoat.

We are very optimistic that Zircoat refractory coating will be found greatly beneficial in solving chronic problems developed in high and low temperature applications and in other heating areas.

We thank our scientists, technicians and workers, who have helped us in succeeding in this venture.

Shyam Merani
President

X-ray Diffractometer

CNC Machining Centers

Main characteristics and advantages of Zircoat

- Easy to apply by trowelling, brushing or spraying
- Good adhesion to metals, refractory bricks, monolithics, castables and ceramic fibre modules etc.
- Excellent dry strength
- Excellent resistance to powdering
- Good adhesion
- Good chemical resistance
- Easy to mix
- Gas-tight surface without spalling or cracking
- Reduction in slag adhesion
- Resistant to severe attack and sand blasting effect of burning fuel oil
- Considerable increase in service life of refractory linings and heating systems
- Resistant to the influence of steam, acids, alkalies, fumes of sulphur and Vanadium compounds and molten metals
- Odourless and nonhazardous

Applications

Zircoat with its high concentration of Zirconia, resists harsh chemical attacks at high and low temperatures. Around 3mm thick Zircoat coating can work wonders at ambient to 1800° C temperature.

5mm thick Zircoat coating offers as good a protection and insulation as a 130mm thick insulation fire brick.

Zircoat prevents leakage of hot gases from heating chambers, thus maximum heat energy is preserved, wear and tear on the Zircoated surface is minimised and coating lasts longer.

Zircoat has unlimited applications and is used in the following areas where continuous and high temperature heating is found hazardous, specially in the heating chambers constructed with conventional materials.

- Ceramics/Glass
- Aluminium, brass and other nonferrous metals
- Chemicals and fertilizers
- Pulp and paper
- Natural and other gases
- Petroleum and hydrocarbon
- Iron and steel
- Marine and shipping
- Cement
- Sugar
- Coating of kiln furniture, graphite and carbon crucibles.

Zircoat coating will be of great benefit to use in the above areas as well as in domestic boilers, induction furnaces, rotary kilns, chimneys, ducts, etc., where fuel oil, gas or electricity are used for heating purpose.

The making of Zircoat

Jyoti Ceramic Industries, introduces Zircoat, a newly developed Zirconia-rich, high temperature, erosion/corrosion-resistant ceramic refractory coating compound.

Looking at the acute need of industries for a suitable refractory coating compound, which can withstand high temperatures and also control erosion/corrosion of refractory linings, monolithics, ceramic fibre boards, modules and steel shells, we initiated a project to develop a suitable refractory coating compound with the required features.

After long years of efforts, we succeeded in developing Zircoat, a special refractory coating compound with high percentage of Zirconia in its residual. Zircoat seals the cracks developed on the inside walls of combustion chambers and prevents loss of hot gases escaping through them; thus conserving fuel energy loss which experts conservatively estimate at around 33%.

We have vigorously tested Zircoat at 1300 to 1780° C, in high temperature, electric, gas-fired kilns and found its performance extremely satisfactory. Zircoat considerably prolongs the life of refractories and steel shells of high-low temperature kilns.

Zircoat is the outcome of the untiring efforts put in by our scientists and technicians, backed by a state-of-the-art R&D laboratory.

Zircoat marks the development of a unique refractory coating compound, which will prove greatly beneficial to the industries where erosion/corrosion is a severe and chronic problem for refractories and kiln steel shells.

Physical Properties

• Colour	Cream
• Density	3.28gm/cc
• Wt. per cft	210lbs/95 kgs
• Bulk factor	2.11
• Cold crushing strength	350kg/cm^2
• Thermal expansion 0-1800° C	<1.0%
• Shrinkage at 1800° C	<0.25%
• Thermal shock resistance	Excellent
• Electrical properties	Good insulation
• Temperature resistance	>1800° C

Chemical Analysis

• ZrO_2	65.20%
• SiO_2	31.09%
• B_2O_3	0.75%
• Al_2O_3	1.00%
• TiO_2	0.4%
• Fe_2O_3	0.08%
• CaO	1.08%
• MgO	0.40%

THE USE OF ZIRCOAT IN FURNACE BUILDING

Nonferrous Metal Industry

Zircoat is excellent for use in ferrous and nonferrous metal and other alloy industries.

In aluminium, brass and its alloy industries, alumina refractory bricks which come in contact with molten aluminium or other nonferrous metals get corroded faster because their alumina content gets leached out. Zircoat which contains higher percentage of Zirconia in its residual is incompatible with molten metals. Therefore 3 to 5mm thick Zircoat coating on the face of refractory brick linings acts as a barrier and an armour to molten metals which arrests leaching of bricks, thus considerably enhancing the life of the heating chambers.

Iron and Steel Industry

- In cast iron and steel industry, apply around 6mm thick Zircoat between ganister and steel shell of the heating chambers of the cupola and accordingly suitable thickness coating for patching receivers, ladles, funnels, spouts etc., and over refractory bricks in reheat furnaces, soaking pits, open hearth floors, furnace doors, sloping floors etc.
- Zircoat is used as a lubricant in the preparation of steel ingots for better quality and better finish of steel plates, castings etc.
- Zircoat acts as a barrier and as an armour coat on the linings of electric furnace, producing special grade steels.

Chemical Industry

In many chemical processes, corrosive waste gases and chemicals at high temperature cause havoc to the steel structures, such as chimneys, ducts, furnace shells etc. Waste gases usually contain oxides of sulphur and vanadium. Even at low temperature, the area of acid-resistant bricks collapses because the cement mortar decays under the attack of sulphuric acid. In such cases, Zircoat coating increases the life of heating systems considerably due to its resistance to acids and waste gases. The service life of chimneys, steel shells and ducts can be extended multi folds if coated with Zircoat.

Fertilizer Industry

Generally frequent breakdowns are experienced in high-temperature zones. In chemical processing units 3 to 5mm thick Zircoat will work as a barrier coat between heat transfer walls and corrosive chemical gases. This prevents costly breakdowns.

Town and Natural Gas Industry

A process called cyclic process, carries out the conversion of waste chemicals from oil refineries to industrial heating gas or town gas. Waste refinery gases and heavy naphtha are heated up for a few minutes in converters, where temperature suddenly rises from 105 to 980° C. This tremendous temperature bounce occurs every couple of minutes; the thermal shock, thus developed can shatter the refractory linings in no time, which can cause explosion of semi-burnt gases under pressure-resulting in heavy losses. 12mm thick Zircoat coating on the steel sections of the reacting areas of gas producing units will considerably increase the service life of chambers. The coatings can perform satisfactorily and offer prolonged protection. The life of heat transfer units of domestic and industrial boilers can be improved further by applying 3 to 4mm thick Zircoat over the refractory lining.

SOME MAJOR INDUSTRIES

PETROLEUM &
PAPER
SHIPPING
HYDROCARBON
FERTILIZER
TOWN &
NATURAL GAS

Shipping Industry

In ships, furnaces/boilers producing heat for generation of steam are fired with fuel oil. Because of months of nonstop

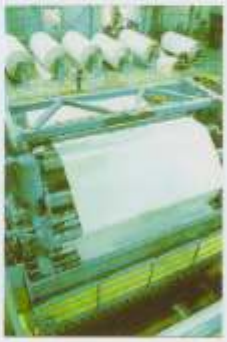
operation of these furnaces/boilers, refractories get severely damaged due to the hot corrosive gases developed from fuel oil. At elevated temperature, presence of small percentage of sulphur-dioxide, trioxide, vanadium pentoxide etc. damages refractory brick work. 3 to 4mm thick Zircoat applied on the refractory brick lining and also if used as a brick lining mortar, will enhance the life of furnaces/boilers considerably. Zircoat is found as an excellent mortar for laying new refractory brick lining in high and low temperature furnaces and kilns.

Petroleum and Hydrocarbon Industry

A huge amount of heat is vital for smooth and efficient running of a refinery. 260 to 2000° C temperature is employed continuously to crack down the crude oil and convert it to useful end products. The refinery runs more economically if the heating process is kept uninterrupted. Continuous high temperature corrodes the plant faster. Zircoat is an ideal remedy to protect the plant from corrosion.

Pulp and Paper Industry

High consumption of thermal energy is necessary for chemical conversion of wood into paper pulp and subsequent recovery of unreacted chemicals involves reliable refractory structures. Regions of high mechanical abrasion (as in ash flumes, the hoods of lime kilns and boilers in which heavy fuel oils are burned) often suffer from rapid erosion. Severe spalling of refractories can occur when they are subjected to violent and frequent thermal shocks, such as in hog fuel boilers where cold and wet fuel comes in contact with hot furnace walls.



In this and in many chemical industries, problem of normal refractory wear developed from thermal or mechanical stresses is further aggravated by chemical attacks by reactive substances present in or produced by pulping or recovery process. Zircoat refractory coating is exceptionally stable and durable under conditions of thermal, mechanical and chemical onslaught encountered in the pulping process. 3 to 4mm thick Zircoat coating can increase the service life of heating systems by many folds.

Sugar Industry

In the sugar industry, plant managers will find Zircoat as an ideal cost-saving remedy for speedy repairs and maintenance of combustion chambers in lime kilns, pulp dryers, steam boilers, gas fired and oil-fired furnaces or wherever sugarcane waste is burned as a fuel.

Zircoat has proved a reliable, economical and cost-saving remedy in sugar producing mills. As a rule, plant repairs are generally carried out before the peak season starts when sugarcane juice is in abundance. Harvesting of sugarcane keeps the plant working at optimum capacity for four to five months at a time. For the rest of the year the plant remains idle when patching and repairs can be conveniently carried out.

In producing sugar from sugarcane, a large amount of sugarcane waste is burned as a fuel. This process produces hazardous chemical gases, which are corrosive at elevated temperatures. These chemical gases damage most refractories

and firebricks, causing heavy breakdowns, which lead to great financial losses. Zircoat is found to be the most suitable remedy for speedy repairs of damaged areas.

Use of Zircoat in Induction Melting Furnace

The refractory brick lining between electric bobbins and silica ramming is the vital part of the induction melting system, and sensitive to thermal shock and physical wear.

Zircoat is used to reinforce these refractory bricks by trowelling with 3 to 4mm thick coating on outside and 5 to 6mm thick coating on inside refractory brick walls. Coating has to be properly dried up to set it hard.

After proper setting of Zircoat, silica sand has to be rammed in between the steel sleeve and 5mm thick asbestos or mica sheet to form an average silica wall thickness of 200mm. Melting of steel starts and the steel sleeve is allowed to melt away and get dissolved in the molten steel. After removing the molten metal from the trough, coating of pure silica is formed on top of the Zircoat coating.

The brick wall is thus reinforced by Zircoat and it becomes super resistant to wear and sudden break downs due to thermal shocks. After repeated usage of Zircoat, service life of furnace can be increased multi folds.

Induction Melting Furnaces

Induction furnaces are used for melting ferrous and nonferrous metals. During the metal melting process, generally following problems are observed:

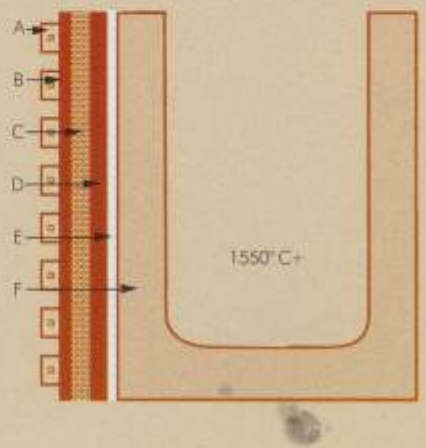
- Rammed silica lining cracks due to thermal shocks.
- Slagging of molten metal passage obstructs free flow of metals.
- Eroding of silica lining.
- Faster leaching out of refractory bricks which come in contact with molten metal.
- Cracking of bricks and escape of molten metals.
- Molten metals getting contaminated because of leached out constituents from lining bricks.

Zircoat is excellent to protect the heating system from above problems.

Kiln Furniture

Life of silicon carbide, mullite, alumina and cordierite refractory kiln furniture can be increased considerably by brushing or spraying with 1 to 2mm thick Zircoat.

Use of Zircoat in Induction Melting Furnace



A Terminals Bobbin

B 3 to 4mm Zircoat

C High Grade Refractory Bricks

D 5 to 6mm Zircoat

E 5 to 6mm Mica/Asbestos Sheet

F Rammed Pure Silica Sand 200mm

ZIRCOAT INCREASES OUTPUT MANY FOLDS

Carbon/Graphite Crucibles

Crucibles are used for melting of ferrous and non ferrous metals. In metal melting process these crucibles are severely affected by molten metals at elevated temperatures, and it is generally experienced that they fail in just few charges.
Life of these expensive crucibles can be extended considerably by applying 2 to 3mm thick Zircoat coating on the inside and outside walls of crucibles.
Since Zircoat is incompatible (unfriendly) with carbon/ graphite, following procedure is suggested for coating the crucibles.
Form a brushable Zircoat paste by mixing 5% Sodium Silicate solution in clean tap water. Ensure that crucible walls to be coated are rough and clean enough so that the coating adheres well over them. Apply 2 to 3mm thick Zircoat by brushing and allow the coated areas to dry out for a couple of days in warm atmosphere. The first heating of crucibles should be slower than normal. Around 2mm thick Zircoat coating can double the life of crucibles.

Caution: Improper drying of Zircoat coated crucibles may cause cracking/shattering during first heating.

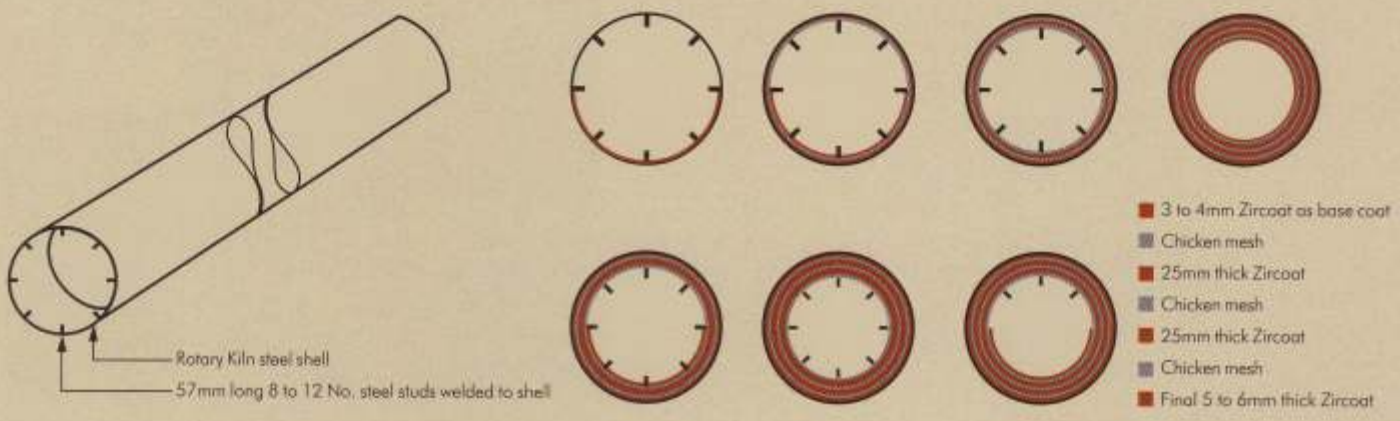
Rotary Kilns

Zircoat is also an ideal and excellent refractory coating for rotary kilns, chimneys, ducts etc.
25mm thick Zircoat coating is sufficient for obtaining superior results. It reduces the gross weight of the rotary kiln and eliminates the risk of thermal shock damages.

Procedure for application of Zircoat to Rotary Kiln

- Weld 6mm dia x 57mm L steel studs to the inside tubular kiln chamber wall at (12") 305mm centres.
- Apply around 25mm thick Zircoat coating (in convenient small thickness layers) on the bottom half of the cylinder and fasten a mild steel wire mesh to the bolts over the coated area and press it tightly. The Zircoat coated shell has to be heated for around 24 hours at temperature 200° C to completely dry out the moisture and set the Zircoat hard.
- After thoroughly drying out the Zircoat, again apply a second coat of 25mm thick Zircoat on the surface of wire mesh and repeat a further layer of wire mesh tightly secured over the coated area, once again thoroughly dry up the coated area at 200° C for further period of around 24 hours. This makes total thickness of Zircoat coating around 55mm above the steel shell. Again tightly fix up the wire mesh over the coated area and apply a final coat of around 5 to 6mm to ensure that the steel studs are totally immersed in Zircoat. System should be heated up for around 54 to 60 hours at 200° C and ensure that all the moisture is completely removed. After that the temperature can be increased at the usual rate.

Application of Zircoat to Rotary Kiln



Procedure for application of Zircoat to chimneys and ducts

6 to 12mm thick Zircoat coating prevents steel sections from the attacks of the hot corrosive gases escaping upwards. Zircoat effectively acts as a barrier against corrosive gases and absorbs chemical attacks. The coating procedure is given as under :

- Weld 6mm dia x 25mm long steel studs to the inside steel chimney wall at around 300mm centres.
- Apply 6mm thick Zircoat on the inside section of the chimneys and fix with a steel chicken wire mesh to the bolts.
- Heat up the Zircoat coated chimney cylinder at 200° C temperature for around 20 hours.
- After heating, apply final coat of 2 to 3mm thick Zircoat on the laid out wire mesh to level the coated area and to totally cover the wire mesh and steel studs. Dry up the Zircoat coated area thoroughly.

Zircoat is of great advantage to high and low temperature tunnel and shuttle kilns. It considerably extends service life of kiln cars and kiln combustion areas.

1 to 2mm thick Zircoat coating on the heating area increases its service life by 4-5 folds as compared to the uncoated ones, and also saves on fuel energy by preventing heat energy losses due to leakage through the lining cracks.

Zircoat should be applied on clean surfaces only. Old refractory surfaces must be thoroughly cleaned with a scraper or wire brush, removing all loose pieces and particles. Any glossy surface should be thoroughly roughened with an abrasive disc. Cracks and holes should be cleaned and then filled with a thick Zircoat paste.

Mixing of Zircoat

For trowelling application

Thoroughly dry mix the Zircoat powder, add clean tap water to it to form a smooth paste of toothpaste consistency. Add required quantity of water to adjust the consistency of the mix to suit brushing, trowelling or spraying applications.

To prepare mortar for repairs or plugging, use less amount of water in the mix. The pot life of the good mix is for around 8-10 hours at room temperature. Therefore consume the mix during this period.

For trowelling, brushing or spraying of furnace walls, hearth, ceiling, bridges etc., Zircoat mortar thickness should be around 3mm. If required, further coats can be repeated at hourly intervals to increase the coating thickness.
Zircoat coating should be thoroughly dried out.

Zircoat is also used as a cementing mortar for building and laying of new refractory brick lining for which minimum 7 to 8 days drying period is recommended.

Firing schedule

Raise the temperature at the rate of 20 to 25° C per hour upto 600° C evenly and thereafter the furnace may be further heated up to a final temperature at the usual firing schedule.
2.5kg Zircoat covers around 1mm thick 1sq. meter area.

Shelf life

One year + in close airtight container.

Packaging

Zircoat is available in strong airtight polythelene lined plastic containers, containing 5, 10, 25kgs. Also larger quantity (50 kgs and above) packing is available in tropic-proof tough polythelene lined stackable steel drums. Such containers are packed in multiples on strong sea worthy pallet type wooden crates.

Guidelines to use Zircoat efficiently

Precaution : After coating the area with Zircoat the first firing should be carried out slowly to avoid development of any surface cracks or other defects due to the moisture content in the coating material.

The applied Zircoat coating should be air dried for minimum 24 hours and then slowly raise the temperature to 600° C at 20 to 25° C/hr and then to operating temperature at around 50° C/hour.

- The surface to be coated with Zircoat should be cleaned thoroughly.
- Refractory surface should be cleaned with scraper or wire brush removing all loose pieces, particles etc.
- Glossy surface should be roughened enough with an abrasive disc.
- Before applying Zircoat, the surfaces of refractories, castables etc. should be dampened with water.
- Metal surfaces, should be free from any grease, rust or oil. Grease or oil should be cleaned with trichloroethylene and rust with rustoline. The surface should be roughened enough with an abrasive disc or sand blasting.
- Before mixing water to Zircoat powder, it should be thoroughly dry-mixed. Then water should be added and mixed homogeneously for better adhesion. The pasty mass should be consumed within the stipulated pot life of 8 to 10 hours.
- Mixing, applying, drying and first firing should be done strictly according to the procedures laid down in the brochure.
- If coating beyond 2mm is applied, it should be in multiple layers for proper drying.
- After consuming part quantity, the left out Zircoat dry powder should be kept air tight to avoid absorption of outside moisture. This will ensure longer service life.

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