

Polished concrete floors – affordable, energy efficient, dust free & low-maintenance



Background:

Polished concrete is a generic term covering a variety of decorative concrete flooring options which leave a concrete surface exposed as the final floor finish. Polished concrete floors provide a wide range of colours and finishes. They are affordable, energy efficient, low-maintenance and dust-free.

The concept of a polished finish dates back some 20 to 30 years and was originally used to describe the process whereby a typical grey or coloured concrete floor was coated with a wax product and then highly polished. The wax used was generally powdered beeswax which was melted and mixed with turpentine, and a mineral pigment, if required. It was applied while still warm (and liquid), with powdered french chalk sprinkled over the surface some 12 hours later. The surface was then polished by rubbing vigorously with a soft cloth. Hence the term 'polished concrete floors'.

Colours can be introduced by colouring the concrete and/or by using special aggregates, while patterns are achieved with inlaid strips, joints, tiles or abrasive blasted and scabbled finishes forming borders around individual areas.

While polished concrete finishes have been generally associated with slab-on-ground type construction, they are equally applicable to suspended slabs. Also, on wall panels cast horizontally (tilt-up or precast) all the decorative options normally associated with floors can be utilised.

As with any other specialized technique, polishing is a multistep process requiring use of the proper tools and equipment to achieve top-quality results. To help you get started, here's a brief overview of the polishing process and a checklist of basic equipment and supply needs, along with some buying tips. Note that each job will present different conditions and challenges, so be sure to consult with your equipment and material suppliers for recommendations as to the products best suited for your application.

Although it is the most basic polished finish, a good quality **steel trowelled finish** with a performance surface sealer applied will often provide the required finish. Steel trowelled finishes may be achieved by hand or power trowelling machine (often referred to as a helicopter).

A '**burnished**' concrete finish will usually be specified where a surface free of trowelling marks is required. It is produced by steel trowelling until a very smooth finish and glossy appearance is obtained. The additional trowelling required to produce this finish will ensure that no trowelling marks remain. However, the extent of trowelling may also 'burn' the surface as the trowel must be passed over the surface while the concrete is quite 'dry'. This may result in some areas having a darker colour.

WHAT CAN DAMAGE CONCRETE?

- Acids / Alkalies
- Cleaning chemicals
- Vegetable oil
- Vinegar
- Kitchen fats
- Sugar
- Ethylene glycol, mineral oils
- Beer, wine

However, **polishing / grinding** provides the most-durable and most-versatile polished finish. It involves grinding the concrete surface (with progressively finer abrasives) until the desired gloss/lustre is achieved. Grinding (depending on the depth) will expose the aggregates used in the concrete.

'**Terrazzo**' is the name traditionally used for ground concrete incorporating marble aggregate; it is now often used to cover honed concrete containing other aggregates. Glass has sometimes been added to give a translucent appearance, but this is not generally recommended since undesirable reactions can occur between the silica in the glass and the alkalis in the concrete

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What's new?

Control of the concrete mix itself – for maximum durability, aesthetic appeal

Today, reputable ready mixed concrete suppliers offer a higher quality control of the concrete mix than ever before. It is recognised that concrete mix design is critical in any application. The concrete mix itself can solve problems or it can create them. What is really needed in a concrete mix is one that is easy to place, strong enough to meet the needs of the application, durable for the life of the floor or wall, and one that will look good when the decorative work is done. Rather than only specifying how much cement is in the mix, ideally specify permeability, shrinkage, workability and compressive strength. Recognise that climatic conditions will affect the mix design.

Good concrete is good concrete and decorative concrete needs to be very good concrete. For decorative concrete we are seldom looking for very high strength, so the wise contractor will focus on low permeability and low shrinkage. Special aggregates are usually chosen to give a polished stone appearance. Hard aggregates such as quartz and igneous rocks (e.g. granite) are preferred as they polish well and provide a surface with excellent wear characteristics. Aggregate colours, types (round or crushed), sizes, mineral-content, etc can all be selected and blended to produce a variety of finishes including polished granite-type (reconstituted stone) finishes. The cost of special aggregates for large areas can be reduced by using them only in a topping or by seeding them into the surface. Because the latter process is difficult to control for smaller areas, it may be more economical and/or better to simply use the selected aggregate throughout the mix.

Polished concrete can be used as a topping, but there are however a unique set of problems which should be considered. Cracks in the base slab can be reflected

through to the polished slab. To minimize the likelihood of such allow to repair the crack first with epoxy, and mesh over the crack before pouring.

Extensive availability of equipment – Kennards Concrete Care

Thanks to recent advances in access to the availability of professional grinding and polishing equipment, concrete floor surfaces— whether new or old—can be ground to a an extremely high-gloss finish very economically. Since they offer superior durability and ease of maintenance, polished concrete has become a popular flooring surface in warehouses, retail spaces, schools, and other high-traffic facilities. But polished concrete serves much more than a utilitarian purpose. It's also an economical flooring alternative for homeowners or businesses that can't afford pricey marble or granite floors but want the same brilliant, mirror-like finish.

Kennards Concrete Care – see *sidebar* – is playing a major role in the industry by providing access to a wide range of rental equipment nationwide. The industry benefits from their professionalism and corporate strength.

New protection systems

Concrete is a very durable engineering material. However, surprisingly, even weak acidic solutions attack concrete by dissolving the cement paste and calcareous aggregates. And it can be easily stained. Once a polished concrete floor starts to deteriorate, it loses its lustre and primary function. Dusting and cleaning difficulties begin...

WHY COAT CONCRETE?

- Eliminate dusting
- Eliminate staining
- Provide chemical protection
- Make cleaning easier
- Reduce maintenance costs & total cost of ownership

Advances in protection systems are also accelerating the acceptance of polished concrete. New systems are available that densify and seal in a single process. And for ultimate protection, new fully cross linking systems provide excellent durability.

These sealers prevent staining and chemical attack and should keep the finish looking good for many years.

Polishing / grinding basics:

Grinding concrete is very similar to sanding wood. Machines equipped with diamond-segmented abrasives (akin to sandpaper) are used to grind down concrete surfaces to the desired degree of shine and smoothness. Eventually, "grinding" gives way to "polishing". As when sanding wood, gradual progression is made from coarser-grit to finer-grit abrasives. (In this case, grit is the particle size of the diamond.) The result is a glossy, mirror-like finish. Concrete can be polished using wet or dry methods. Although each has its advantages, dry polishing is the method most commonly used in the industry today because it's faster, more convenient, and environmentally friendly. Wet polishing uses water to cool the diamond abrasives and eliminate grinding dust. Because the water reduces friction and acts as a lubricant, it increases the life of the polishing abrasives. The chief disadvantage of this method is the cleanup. Wet polishing creates a tremendous amount of slurry that crews must collect and dispose of in an environmentally sound manner.

With dry polishing, no water is required. Instead, the floor polisher is hooked up to a dust-containment system that vacuums up virtually all of the mess.

Checklist of equipment and supply needs:

A concrete grinder is the indispensable workhorse on any polishing project. Look for a machine with a planetary drive system—a large primary polishing head (ranging from 420 mm to 920 mm and beyond in diameter) fitted with three or four smaller planetary satellite heads that hold the diamond abrasives. When the machine is operating, the satellite heads rotate in the opposite direction of the primary head to eliminate linear grinding marks in the floor.

Kennards Concrete Care is the specialist equipment hire company that has been helping contractors tackle a range of concrete related jobs from demolition, grinding, stripping, drilling and cutting through to cleaning for over 6 years. Work is safer and more productive with the latest equipment from Kennards Concrete Care. They stock all leading brands that are renowned for reliability and performance. When new and better equipment is developed, they buy it, so it can be immediately hired.

With no capital outlay, a polished concrete professional can have immediate access to a huge range of the most modern tools and equipment, saving on labour costs and eliminating the concerns of registration, depreciation, storage, repairs and maintenance and down time.

Kennards Concrete Care offers the latest equipment including:

- Grinders
- Concrete mowers
- Floor strippers
- Scabbers
- Shot blasters
- Concrete planers
- Profilers



Buying / hiring tips: Floor polishers can weigh anywhere from 100 kg to 600 kg. Heavier machines produce greater friction levels, resulting in a higher polish. If polishing dry, be sure your machine is equipped with a built-in vacuum port to collect the dust.

Handheld polisher or walk-behind edging tool (150 mm in diameter or smaller) to work along edges or in tight spots where a large walk-behind floor polisher can't manoeuvre.

A set of diamond-segmented abrasives in various grit levels, ranging from about 16 to 3000 (the higher the number, the finer the abrasive level). You'll need two basic types of abrasives: Coarse diamond segments bonded in a metallic matrix for surface preparation and initial grinding (from 16 to 300 grit) and finer diamond segments embedded in a resin matrix for honing and final polishing (from 100 to 3000 grit). See *Summary of the Basic Polishing Steps*. If the job requires removing thick elastomeric membranes, coatings, or mastics from an existing floor, it may be necessary to purchase a more aggressive grinding head specifically designed for removing heavy coatings and mastics.

Buying tip: The choice of polishing abrasives depends on the condition of the surface and the hardness or softness of the material being polished. Consult with your supplier to determine the right diamond tooling to use for a particular application. A basic starter's kit should include at least three abrasives at each grit level. (Most suppliers colour-code their diamond abrasives by grit level for easy identification.) Be sure the diamond tooling is sized to fit the satellite heads of your polisher.

SLIP RESISTANCE ISSUES:

Australian/New Zealand Standard AS/NZS 4586:2004, Slip Resistance Classification of New Pedestrian Surface Materials, provides a means of classifying pedestrian surfacing materials according to their frictional characteristics. This standard enables characteristics of surface materials to be determined in either wet or dry conditions.

This Standard should be used in conjunction with Standards Australia Handbook HB 197:1999, An Introductory Guide to the Slip Resistance of Pedestrian Surface Materials. This Guide establishes a basis for specifying pedestrian surface materials for various locations.

Any polished concrete surface that can be contaminated with water, oil, food etc in use should be finished with a surface profile that meets the Guide. This especially applies to commercial and industrial applications.

Generally, the surface profile can be achieved by adjusting the coarseness of grind or the application non slip coating.

In the UK, HSE research has identified the levels of surface roughness which are required to penetrate squeeze-films of differing viscosities sufficiently enough to allow acceptable floor friction values.

These are shown below:

Contaminant viscosity (cPs)	Workplace analogy	Minimum surface floor roughness
< 1	Water	20 µm
1-5	Milk	45 µm
5-30	Stock	60 µm
30-50	Olive Oil	70 µm
> 50	Margarine	>70 µm

Dust-collection equipment to capture the dust generated from grinding of the concrete surface. Look for a machine capable of extracting about 99% of the dust from polishing. This will keep the worksite clean and the air quality safe.

Penetrating chemical hardener. After performing initial coarse grinding with the metal bonded diamond abrasives, it's often beneficial to apply a liquid chemical hardener to the concrete to help solidify and densify the surface and provide extra protection from water penetration and staining. Hard concrete also produces a better polish. These products, which can be applied to new or existing floors, work by reacting chemically with the calcium hydroxide in the concrete to form a hard, crystalline structure. They are sold under different trade names, but are usually made of sodium, potassium, or lithium based silicates.

Buying tip: New technology densifier / sealers: EpiMax 2150 is built on unique inorganic chemistry and reacts with the cement paste in the concrete to increase the surface hardness of the concrete. Additionally, this product seals and protects the concrete surface. Water based, single pack, durable.

Repair filler for patching any cracks in existing floors during the surface preparation stage. Use a non shrink epoxy or other semi-rigid crack filler, making sure to level the filler at the surface. This will enable the grinding heads to move more easily over the floor.

Buying tip: New technology highly adhesive / non shrink, Kevlar reinforced, EpiMax 575 is a specially formulated gap filling adhesive that bonds tenaciously to the concrete itself. The product has sufficient flexibility to resist impact, however.

Protective sealer. Once the look and grind is achieved, further chemical protection can be achieved by applying a durable fully cross linked coating. This coating will protect the floor from grease, oil, or chemicals. It also eliminates dusting.

Buying tip: New technology: EpiMax 333WB Express CLEAR is a fast hardening water based epoxy allowing 2 coats in one day with sufficient airflow resulting in an extremely durable protective coating. Green star rated, low VOC.

For highest scuff resistance, consider EpiMax 777HD.

Supplemental power and lighting. Floor grinding machines consume a lot of power. Make sure the facility you're working in has the right electrical outlets and enough power to operate your equipment. Consider investing in a portable generator to eliminate downtime due to insufficient power. Also check the lighting:

Is it bright enough to clearly illuminate the surface you're working on? If not, you'll need to bring in portable halogen lights.

Optional decorative enhancements. The lustrous beauty of polished concrete can be enhanced by using various colouring products and specialty treatments. To add colour, apply chemical stains or dyes to the concrete during the polishing process. For new concrete floors, coloured aggregate, glass pieces, or metal can be seeded into the freshly placed concrete before it sets. The polishing process will reveal these decorative embellishments.

Summary of the general concept:

Concrete polishing is an art. Every project is unique and will have its own installation requirements. Each step may not be apparent from the outset and not all steps may be necessary.

- Remove existing coating with a 30 or 40 grit metal bonded (for thick coatings, use a 16 or 20 grit diamond abrasive or more aggressive equipment specifically designed for coating removal such as an air chisel scaler. Important: do not allow 16 or 20 grit discs to grind the concrete surface).
- Seal cracks and joints with an epoxy or other semi-rigid filler. EpiMax 575.
- Grind with a 30 or 40 grit metal-bonded diamond.
- Grind with an 80 grit metal-bonded diamond.
- Grind with a 150 grit metal-bonded diamond (or finer, if desired).
- Consider the application of a chemical hardener, EpiMax 2125, to densify the concrete. Alternatively consider, EpiMax 2150, a densifier and coating in one application, if this level of grind is acceptable.
- Polish with a 100 or 200 grit resin-bond diamond, or a combination of the two.
- Polish with a 400 grit resin-bond diamond.
- Polish with an 800 grit resin-bond diamond.
- Protect: EpiMax 333WB Express CLEAR or EpiMax 777HD to protect the polished surface and make it maintenance free.