

Prefabricated Vertical Drains





CeTeau



Prefabricated Vertical Drain

CeTeau

CeTeau stands for innovative ground technologies using a wide range of advanced techniques. One of CeTeau's core competences is the improvement using Prefabricated Vertical Drains (PVD). Prefabricated Vertical Drains also called Wick Drains, are prefabricated drain strips consisting of a polypropylene core extruded into a configuration to transmit a maximum water flow on both sides of the core. The core is wrapped in a non-woven filter, ultrasonically welded at the edges.

Our product has a wide range of applications and is currently used in many civil and geotechnical engineering applications including:

- ▶ Roads
- ▶ Airfields
- ▶ Railroads
- ▶ Embankments
- ▶ Retaining structures



Manufacturing



CeTeau Bangkok Office

History

Prefabricated Vertical Drains (PVD)

The vertical drain system has been used since 1930 to accelerate the consolidation settlement process, induced by the pre-loading of normally consolidated low-permeability soil. By introducing the vertical drains the drainage paths are shortened and, therefore, the time required for excess pore water pressure, induced by the loading operation, to dissipate will be significantly reduced. The depth of drain installation and the applied loads are continuously increasing, which demands a continuous increase in the standards of the vertical drain quality. CeTeau drain is designed for application under the most severe conditions, it has been successfully used for projects where a high drain standard was required. The advantage of using CeTeau-Drain is that it will reduce the construction time and eliminate the risk of slip-plane failures.



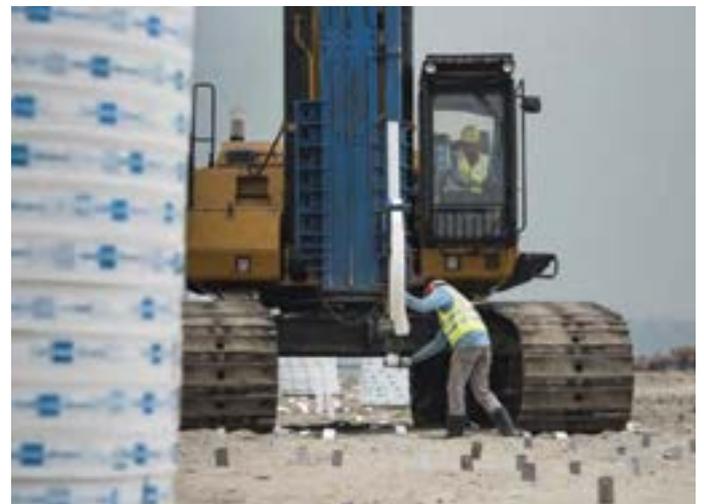
PVD Installation Machine 1935

PVD Installation Machine

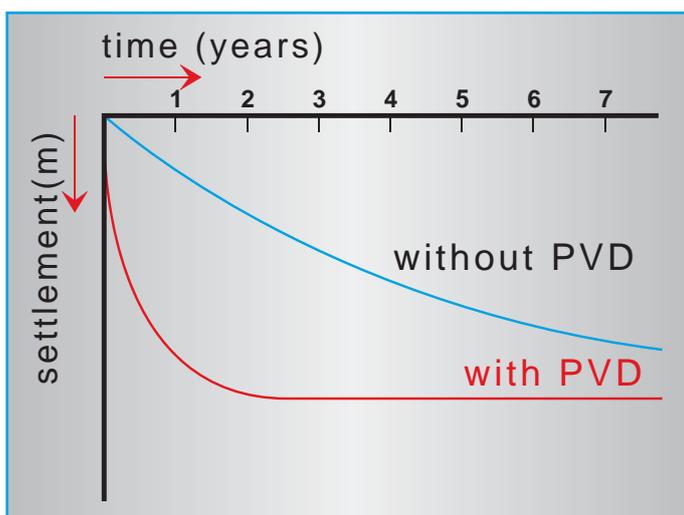
PVDs are relatively inexpensive, provide high water conductivity and can easily be installed at close spacing, thus shortening the path of the pore water in the impermeable soil and expediting the consolidation process. The graph below shows the effect of PVD in the consolidation process.

The advantages of PVD

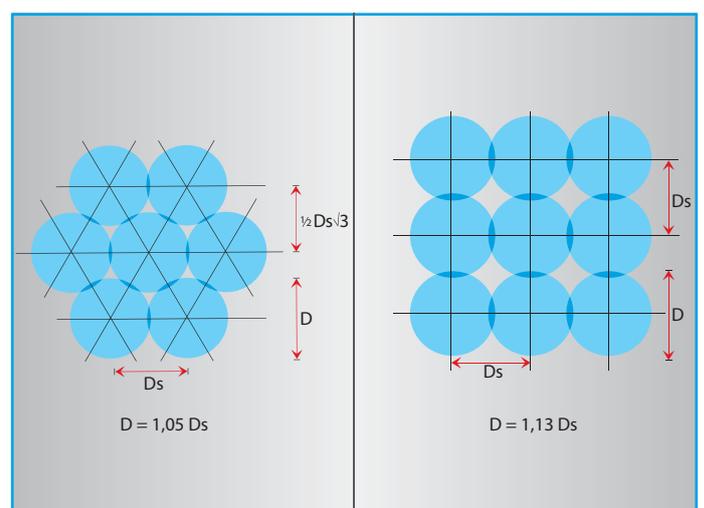
- ▶ Limited disturbance to the substrata
- ▶ Capable of Installation to a depth of 60 m
- ▶ Monitoring of the installation process
- ▶ High installation speed 1500 m/hr
- ▶ Close spacing is possible
- ▶ Proven performance



Modern PVD Installation Machine



Settlements



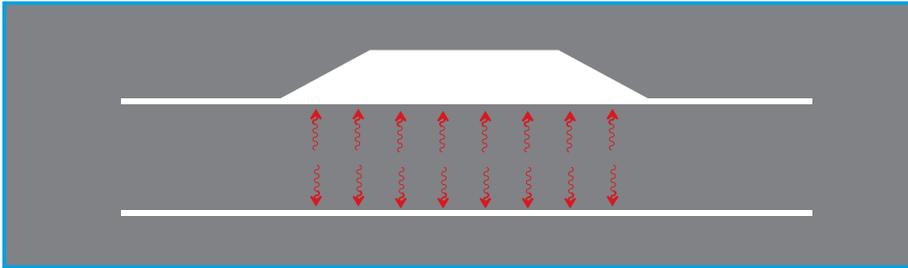
Triangular Spacing

Square Spacing

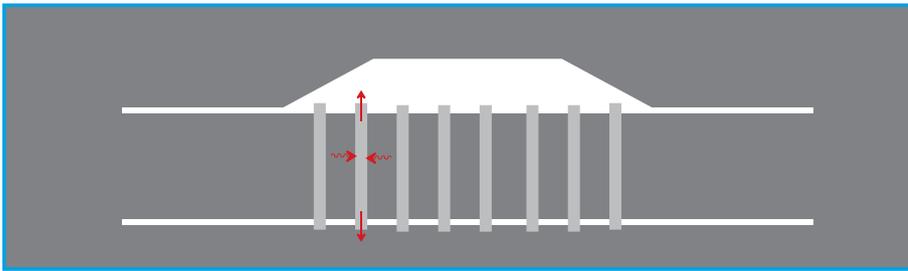
The principle of vertical drainage

Consolidation Principle

Consolidation of compressible soils involves the removal of pore water from the soil. Pore water pressure refers to the pressure of groundwater held within the gaps (pores) between soil particles. The removal of pore water is normally effected by applying a surcharge or preload to the construction area and to squeeze the water out of the



Without Drains

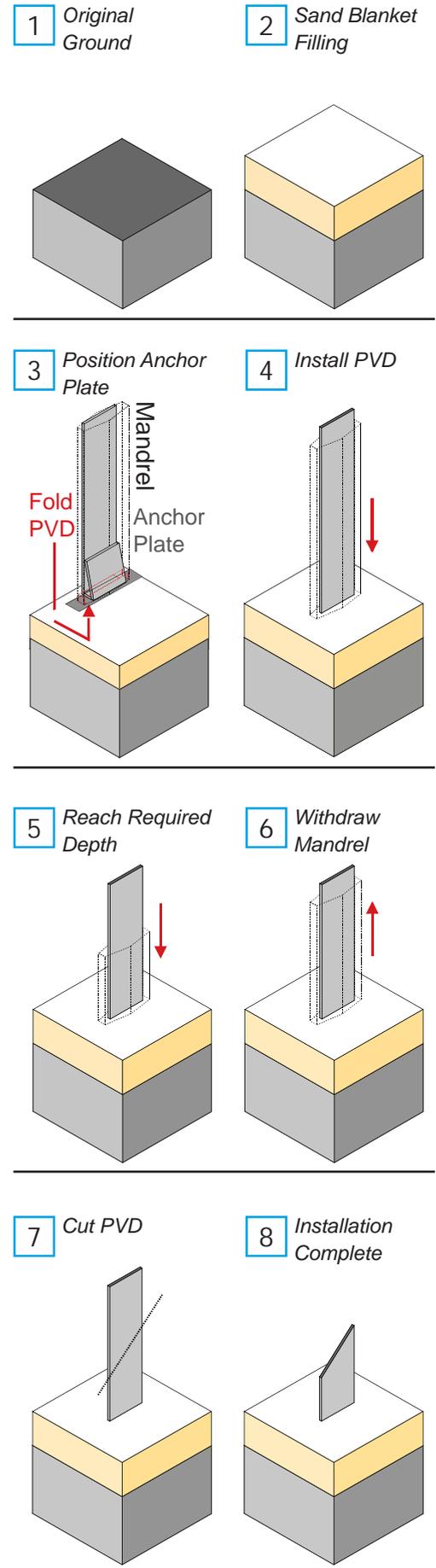


With Drains

Unfortunately, compressible soils are also often soils with a low-permeability (peat, silt, clays), and as such the water is not easily squeezed out. Without the use of CeTeau-Drain, consolidation settlement in saturated clays can take years, because their hydraulic conductivity is extremely low, and this causes the water to take an exceptionally long time to drain out of the soil. The pore water has to travel through the soil vertically up, or down, to dissipate and it can take decades before a new equilibrium between the effective stress of the soil particles and the pore water pressure is reached. To facilitate the de-watering process, prefabricated vertical drains are installed into the soil, providing a conduit for the water flow. By installing prefabricated vertical drain the excess pore water can flow horizontally to the vertical drain and dissipate vertically through the drain.



Drain Rolls on Site



Schematic Installation process

Applications

Main Application

Vertical drains are mostly used to accelerate the settlement and thus reduce the construction period of a project and avoid post-construction differential settlements. By applying a temporary preload on top of the embankment or fill, the consolidation period can be reduced even more. On top of that, part of the secondary settlement is also eliminated. Especially in peaty soils an extra preload can be very effective.

Other Applications

- ▶ Stabilization of slopes by increase in shear strength of underlying soils
- ▶ De-watering to lower aquifers
- ▶ Vacuum consolidation
- ▶ De-gassing of landfills

Special types of vertical drains are developed to meet the requirements for the different applications. CeTeau can advise you which type of drain is suitable for your application.



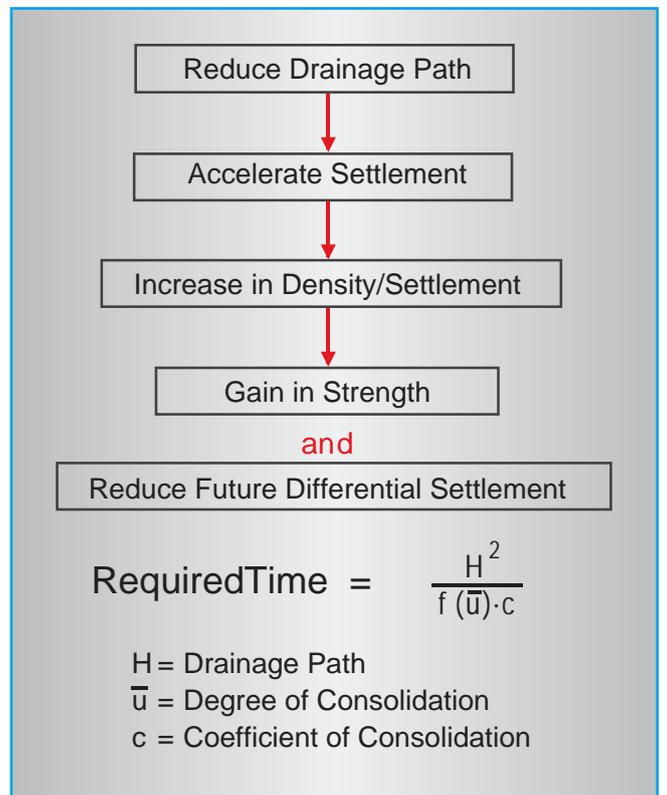
Quality Control



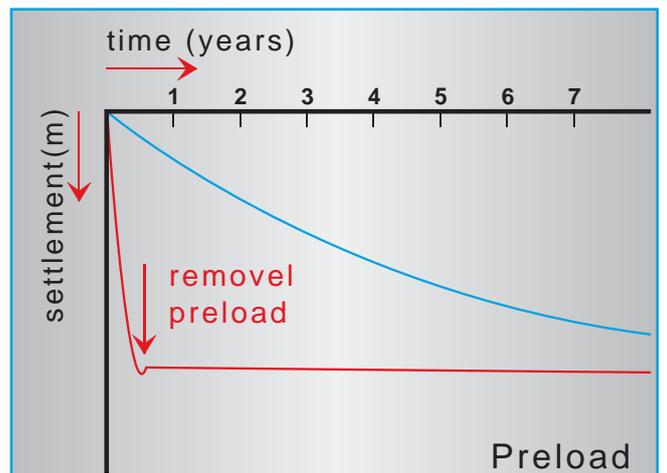
Manufacturing Process



PVD Installation for a Tank Terminal



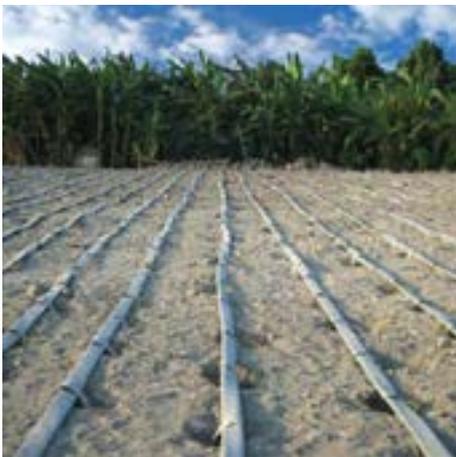
Effect Vertical Drainage



Settlement Diagram



Horizontal Stripdrain



Stripdrain Installation

Stripdrain

The use of CeTeau composite strip drains for lateral drainage on Prefabricated Vertical Drain (PVD) projects can provide a cost-effective alternative to the use of a sand or granular drainage blanket.

Strip drains are placed under the surcharge to receive the flow from the vertical drains and conduct it laterally to discharge points at the edge of the surcharge.

Advantages

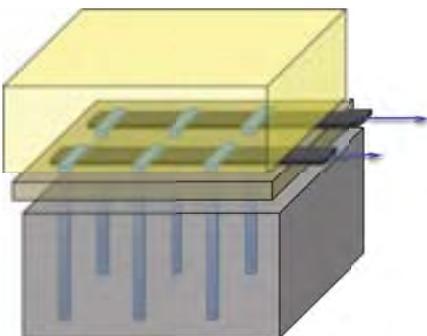
- ▶ Light Weight
 - ▶ Low Costs
 - ▶ Engineered, Proven Performance
 - ▶ Simple Installation Process
- Replaces Granular Materials

The Principle

For vertical drains to function properly, a drainage path must be provided to receive flow from the drains and conduct it from under the surcharge to appropriate discharge points. This lateral drainage system must perform without applying excessive back-pressure to the vertical drains, thus delaying the consolidation process.

The traditional method of providing lateral drainage has been to install a sand layer, usually about 1 m thick, under the surcharge.

The use of composite strip drains can reduce, or even completely eliminate this sand or granular drainage blanket.



Schematic Representation

Quality

Manufacturing

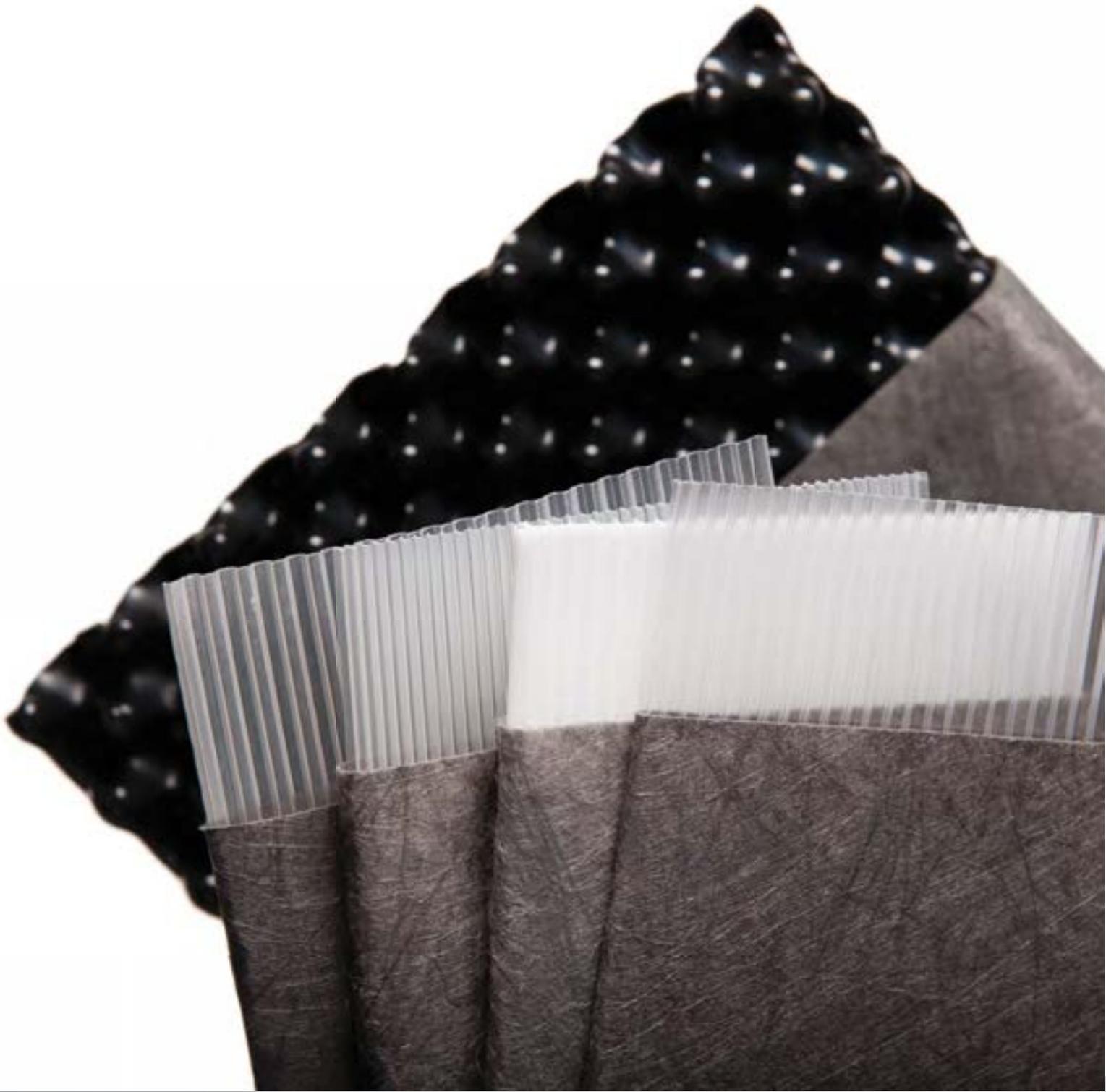
CeTeau-Drain is manufactured in modern plants in Thailand and Malaysia. It is designed to meet all criteria which are important to achieve a successful and effective consolidation of compressible soils. The synthetic nature of the product makes them suitable for use in the ground where high levels of durability is required. CeTeau drains are manufactured from high-grade polypropylene, this material does not contain any additional chemicals that can pollute the soil. The filter jacket ensures high tensile strength in combination with a low elongation, so that deformation of the drain at high lateral pressure is kept to a minimum.

The production facilities in Thailand as well as Malaysia have been certified according to the ISO9001:2008 quality management systems standard by the UKAS-accredited certification bodies AJA Registrars (AJA08/12988) and Global Group (7556213810) respectively. The Thai plant also operates under ISO14001:2004 environmental management systems standard, accredited by AJA' Registrars certificate No. : AJA13/16511.



Manufacturing





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