

# Standard Design Criteria (StDC)

## Basic Requirements

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LafargeHolcim



**Change Index**

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## Health & Safety



### **Health and Safety is the overarching value of LafargeHolcim.**

At LafargeHolcim, we want to do more than prevent accidents, we want to create a healthy and safe environment for our employees, contractors, communities and customers based on a true safety culture.

Health and Safety is at the center of everything we do, from the daily routines in our plants to our customers' project worksites and our actions in our neighboring communities. Our aspiration is to conduct our business with zero harm to people. We believe in visible leadership and personal accountability for Health and Safety at all levels and throughout our organization.

### **To reach this aspiration, we are committed to:**

- Maintain a global Health and Safety Management System designed to continuously improve our performance and actively manage risk in our business.
- Drive for operational discipline by instilling a mindset of safe execution and follow-up.
- Communicate openly with all stakeholders on relevant health and safety issues.

# Introduction

## The objectives of the Standard Design Criteria

- Provide standard technical specifications based on proven technologies and practical experiences from plants.
- Aim toward achieving high Overall Equipment Efficiency (OEE) and Mean Time Between Failures (MTBF) values during the expected life time of the assets
- They are recognized by Suppliers as LafargeHolcim Standard.


## General instructions

- The Basic Requirements document contains general specifications applicable for Mechanical, Electrical and Civil design
- The Mechanical Equipment, Electrical Equipment and Systems, and Civil and Structural Works documents shall be used in conjunction with the Basic Requirements section
- Specifications for Mechanical, Electrical and Civil components of the projects shall be reflected in the Data Sheets; they are intended to standardize the way Suppliers present specifications to LafargeHolcim

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## 1. **GENERAL INSTRUCTIONS**

- a) All statements and paragraphs marked with  are design provisions for safe construction, operation and maintenance of the facility. Deviations and exceptions are not allowed, unless approved in writing by all contractual parties.
- b) All Works shall be of a standard equal or better than specified in this Standard Design Criteria (StDC) and as laid down in relevant international and national standards.
- c) The Works including the engineering, procurement, construction, pre-commissioning, commissioning, start-up and testing of the Works and each component thereof shall be based upon and comply with the Standard Design Criteria, and comply with applicable law, codes and standards.
- d) The Standard Design Criteria lists certain codes and standards. In the event that any such specified codes and standards are inconsistent or conflict with any codes or standards required by applicable law, the most stringent standard shall govern the Contractor's performance.

## 2. **PLANT CLASSIFICATION: MECHANICAL, ELECTRICAL EQUIPMENT, CIVIL AND STRUCTURAL WORKS**

Plant classification follows the specification as per Asset Coding System (ACS) Manual. The Contractor shall adopt the mentioned Plant classification thus ensuring proper identification of all Equipment and the associated Cost of the Works. Also refer to paragraph 4.3.7 Identification / Marking.

## 3. **EQUIPMENT STANDARDIZATION, MATERIALS AND STANDARDS**


### 3.1 **Equipment Standardization**

The use of identical Equipment and components shall be maximized throughout the Project, where practical, thus minimizing spare parts inventory while at the same time optimizing maintenance procedures and parts interchangeability.


Equipment includes:

All Equipment or components performing similar functions at similar capacities, shall be identical in make, model and size and shall include identical components and parts such as bearings, motors, seals, drives, control devices, etc.

### 3.2 **Materials and Standards**


- a) The metric system (SI-units) applies exclusively for the design of the Plant including all Equipment, provided that it is accepted for construction, fabrication, erection, safety and environmental purposes in the country of project execution. This requirement is extended to all documents, e.g. all specifications, drawings and operation- and maintenance manuals. 

The Contractor shall always include all metric equivalents on all drawings and specifications, should the metric system not apply for any portion of the Plant.

- b) **Dangerous and Hazardous Substances** need to be clearly labeled, identified, declared and reported following the hazard classification system applicable in the US, EU or shall following an equivalent standard. All cargo, carriers and containers etc. used for such substances shall meet this requirement, declared in the respective forms i.e. Material Safety Data Sheet (MSDS) and reported at all times. MSDS shall be provided fully filled in indicating any Workplace Exposure Limit (WEL) defining exposures levels that shall not be exceeded. 



Hazardous materials (inflammables, gases, acids, explosives, etc.) shall be stored in suitable locations, to avoid pollutions, fire and explosions.

Proper ventilation, accesses, containment, and security shall be provided according to specific requirements or local regulations.

- c) **Prohibited and restricted substances** as declared by International and Local regulations and standards cannot be used. 

## 4. SAFETY AND MAINTENANCE ASPECTS

### 4.1 General

- a) The overall design shall be performed in a way to facilitate safe assembly and erection at site and method statement shall be provided. The design shall allow for maximum pre-assembly in order to minimize site fabrication and works. 
- b) Overall design shall ensure ease of maintenance and repair and result in facilities with adequate provisions for safe operation, servicing and maintenance. Provisions shall be made for proper maintenance and for the easy removal and replacement of mechanical, electrical and other equipment. 
- c) The sizing of rooms and the location of equipment shall ensure adequate clear space for equipment maneuvering and maintenance operations. The arrangement of valves, control equipment and similar items shall ensure easy access and shall not be in concealed areas.
- d) In the selection of materials and equipment, due consideration shall be given to the availability and cost of replacement parts and the need for special tools and instructions in performing maintenance operations.



## 4.2 Safety



### 4.2.1 General

The Contractor shall ensure conformity of the Works in every aspect to European Safety Standard as well as the applicable Local Safety Standard in the country of project execution. The more stringent Standard applies in case of conflict.

### 4.2.2 Potentially explosive atmospheres

Equipment located in areas with potentially explosive atmospheres (Ex zones) shall be designed according to the applicable international or local standards defined for the corresponding zone following the ATmosphères EXplosibles (ATEX) directives or equivalent. The demarcation of all Ex zones shall be clearly documented by the Contractor and submitted for review by the Owner.

### 4.2.3 Warning signs

Warning signs, to warn personnel of workplace hazards and instruct employees on ways to avoid injuries, shall be in Contract Language and the preferred language of the Project Owner.

### 4.2.4 Start-up alert systems

Every Plant Department shall be equipped with visible and audible start-up alert systems to notify start of process equipment.

All moving machinery shall be equipped with warning devices being activated before and during any movement.

### 4.2.5 Emergency stop devices

Every Plant Department shall be equipped with local manual and automatic emergency stop devices, thus preventing injury to people or damage to Equipment.

### 4.2.6 Guards

Safety guards shall be installed in order to prevent, where possible, any physical contact with moving machinery or moving Components.

Guards shall be easy hand able, colored according Table 5.3.3 and removable only with the aid of a tool, or in conjunction with an interlock.

### 4.2.7 Explosion Vents

The explosion vents shall be located in such a way that the explosion waves propagate away from the building, into open areas, that are made inaccessible to the workers during normal operation of the plant. Restricted access and platform shall be provided to maintain the explosion vent.

#### 4.2.8 Isolation Valves

Lockable isolation valves for compressed air, water and fuels shall be provided at each building entrance or for a set of equipment.

#### 4.2.9 Traffic Plan, Roads and Parking Areas

Access roads to Owner's customer shipping areas, service(s) building(s), and raw material & fuel storage areas shall be kept separate from access to production areas.

A rescue plan shall be considered while elaborating the plant layout.

Pedestrian areas, roads (vehicle traffic routes) and parking areas shall be laid out and designed to provide distinct separation from each other.

#### 4.2.10 Pedestrian Walkways

Pedestrian walkways shall be well marked with a clear separation and delineation from areas that are intended for vehicular traffic. Roadway crossings shall be well marked with appropriate signage alerting operators and pedestrians of the danger. If the walkway passes under a conveyor, overhead protection shall be provided to protect pedestrians from falling objects.

#### 4.2.11 Sub Surface Equipment Installation

Equipment installations below ground level shall be avoided. However well designed pits (with escape routes, space for maintenance, water drainage ...) are acceptable for clinker transport after the clinker cooler and bucket elevator installations.

#### 4.2.12 Permanent life lines and anchor points

Whenever needed, life lines and anchor points shall comply with applicable local Standards (in absence of such, EU Standard shall apply) and shall be provided with affixed labels indicating design load, as well as calculation notes.

Doors and manholes to vertically access confined spaces shall be provided with double anchoring point of at least 3 tons.

#### 4.2.13 Dust collecting hoppers

Dust collection hoppers shall be designed for being 100 % full of material.

#### 4.2.14 Piping

For fixed pipe work, the pipes shall be routed as much as possible away from any vehicle traffic road (to avoid collision damage). If routed alongside a road, protection shall be provided (ex: road railing). Piping signage shall be according to table color code Chapter 5.3.2

Pipes shall be tested against leakage by pressure test or equivalent.

The route of underground pipe work shall be adequately protected from physical damage such as excessive surface loading, ground movement or ground disturbance and clearly marked (with warnings provided by standard colored plastic mesh). If mechanical joints used, they shall be installed in a closed inspection pit, which is readily accessible for inspection.

#### 4.2.15 Forced ventilation

A forced ventilation system shall be provided whenever ventilation is required for regular operation activities.

#### 4.2.16 Emergency Showers and Eye Wash Stations

Emergency showers and eye wash stations with non-contaminated water at suitable temperature shall be provided at least for:

- a) each of the three lowest stages of the preheater
- b) main burner platform
- c) chemical storages
- d) wet-chemistry laboratory

#### 4.2.17 Water

Water accumulation shall be controlled (health issue).

Minimize perturbation of the natural water drainage system and reject flow to the natural environment shall be regulated.

Adequate filtration devices shall be provided to avoid environmental pollution.

### 4.3 Maintenance

#### 4.3.1 Accessibility

All Equipment that require periodic inspection, lubrication, cleaning, adjustment, repair or replacement, or that are designed for manual operation or cleaning, shall be easily accessible by virtue of their location or by means of stairs, galleries or platforms.

#### 4.3.2 Supporting Structures, Maintenance Platforms, Accesses



- a) Anchor points shall be provided to permit the safe use of harnessed access to roofs and sides of buildings.
- b) All supporting structures, maintenance platforms and access facilities to Equipment shall be designed as required to provide the proper and safe access to the Equipment for the purpose of inspection and maintenance.
- c) Silo outlet equipment shall be accessible without ladders and equipped with two sides platform made of grates.

- d) Distance between floor or platform to equipment and instrumentation shall not exceed 1.6m, unless otherwise approved by the Owner.
- e) Platforms have to be dimensioned to provide lay-down areas for spare parts and consumables.
- f) Suitable support systems are to be included for Equipment components and subassemblies fixation as required for safe and proper maintenance and repair of Equipment without damage to parts or components.

#### 4.3.3 Modularity of Equipment

Components of Equipment shall be modular in design thus facilitating easy and fast maintenance, exchange or repair with minimal interference with other components. Quick connectors, plug & socket systems, etc. shall be used to ease maintenance, replacement and repair.

#### 4.3.4 Hoists



- a) Hoists, monorail trolleys and hooks shall be included to enable safe maintenance and repair service.
- b) All hoists, monorail trolleys and hooks shall be designed for the safe lifting and -transfer of the heaviest and the biggest component of the Equipment.
- c) The appropriate installation of I-beams shall be included for Equipment which is moved once a year, or less.
- d) Permanently installed hoists shall be included or design shall enable usage of mobile cranes for more frequently moved Equipment.

#### 4.3.5 Lifting lugs

Equipment to be dismantled for regular maintenance shall be equipped with lifting lugs (or equivalent) and lifting procedure shall be clearly described in the equipment user manual

#### 4.3.6 Condition Based Maintenance

The drives of raw mills, kilns, cement- and coal mills and main process fans shall be equipped for state-of-the art online and/or offline data collection for condition monitoring. Refer to StDC part *Mechanical Equipment*.

#### 4.3.7 Identification / Marking

All Equipment, sub-assemblies, components, units, instruments, pipes and electric cables shall have unmistakable Asset Coding System (ACS) identification. ACS codes shall be appropriately extended where necessary. All markings shall be both in Contract Language as well as in the Project Owner's preferred language. Markings shall correspond with the data, symbols and instructions used in the Operating- and Maintenance Manuals.

Signs shall be provided to indicate the risks on:

- a) Personal protective equipment (PPE) requirement on each area
- b) On equipment and installations, i.e. accessible equipment with surfaces temperature above 60°C.

#### 4.3.8 Access, inspection and clean-out doors on equipment

All equipment shall incorporate access, inspection and clean-out doors as required to assist in daily maintenance of equipment, locating potential problems, verifying the proper operation of the equipment and related instrumentation and control devices.

Access manholes, Inspection and clean-out doors shall:

- a) be provided with suitable platforms and accesses
- b) be located where the worker will not be exposed to danger (e.g. projections)
- c) require a tool for opening
- d) be of hinged design
- e) if potential to swing open, a measure shall be provided to limit the opening or swinging
- f) Access manholes shall be designed to allow passage, minimum dimensions shall be as per the applicable regulations, but not smaller than 610 mm diameter
- g) be insulated when installed on insulated equipment

## 5. QUALITY AND OPERATIONAL ASPECTS

### 5.1 Site Assembly

Equipment shipped to the Site shall be pre-assembled to the considering restrictions for shipping and handling. All Equipment shall be properly prepared for the Site assembly with appropriate alignment holes, match markings and all required temporary bracings. Special devices, parts and tools necessary for proper Site assembly shall be identified and provided with the Equipment.

### 5.2 Welding

All welding materials required for on-Site assembly shall be supplied in the required quality and in sufficient quantity, including spares. It shall be properly packed and marked according to its intended use. Welding instructions shall be included. The Equipment shall be properly prepared for welding.

### 5.3 Corrosion protection, Painting, Galvanization

- a) All steel and cast surfaces of equipment and its supporting steel structures shall have surface preparation and corrosion protection (painting or galvanization) treatment according to the corrosively categories C1 to C5 of EN ISO 12944-2.
- The required category for the project is defined in respective Contract document.
- b) The quality of surface treatment systems for equipment shall be equal or superior to the criteria in paragraph 5.3.1 (Examples of surface treatment).
- c) The color-coding shall meet the requirements of the table in paragraph 5.3.2 (Color Code for Finish Painting)
- Original equipment manufacturer (OEM) standard color is acceptable.
- d) The Contractor shall design its surface treatment systems according to duration class “Medium” (5 to 15 years) or superior, as specified in EN ISO 12944-5, § 5.5.
- e) If there is no seaworthy packing provided the painting shall give a protection against corrosion during sea transport.
- f) The paint required for touch-up painting work during and after erection of the equipment shall not deviate from the initial paint as per specification.
- g) The following procedures shall be strictly followed for all site-painting work:
- Touch-up painting work shall recover all damages on the painted surface of the Equipment caused during sea and land transportation, erection and commissioning).
  - Surface treatment shall be satisfactorily carried out prior to commencement of painting. In particular welding spatters and slag shall be removed prior to painting.
  - The addition of any other dilution (thinners) than requested by paint Supplier is not allowed.

#### 5.3.1 Examples of surface treatment

- a) For each relevant EN ISO 12944 class examples of surface treatment systems of two different corrosion protection and paint specialists are listed in the table below.
- b) The table also lists examples of surface treatment systems which are not covered by EN ISO 12944 for Equipment operated above 120°C.
- c) Qualities equal or superior to the examples listed in the table below are requested.

ISO 12944 CLASS	EQUIPMENT	OPERATING TEMPERATURE Range	WORKSHOP			ERECTION AT SITE						
			PRE-TREATMENT	PRIME COAT EXAMPLES	DFT	TOUCH-UP & REPAIR	CLEANING	FINISH COAT EXAMPLES	DFT			
C2	in- & outdoor	Steel Structures, Sheet Metal, General Equipm.	Ambient up to 120 C	Cleaning according: ISO 8501-1 SIS 05 59 00 DIN 12944 p.4  Blasting according: Sa 2.5 (40 - 60 micron anchor profile)	Surface Tolerant High Solid Epoxy AMERLOCK 400C	100 micron	Remove rust to at least St 2.	Cleaning of total surface before application of the finish coat.	Aliphatic Polyurethane AMERCOAT 450-Series	50 micron		
					Surface Tolerant High Solid Epoxy NEOPLAST SF 30	80 micron			Polyurethane SF 11 / SF 12	50 micron		
C3	in- & outdoor				Ambient up to 120 C	Surface Tolerant High Solid Epoxy AMERLOCK 400C			150 micron	Touch-up any transport or erection damages on the coating and feather surrounding edges.	Aliphatic Polyurethane AMERCOAT 450-Series	50 micron
						Surface Tolerant High Solid Epoxy NEOPLAST SF 30			100 micron		Polyurethane SF 11 / SF 12	80 micron
C4	in- & outdoor				Ambient up to 120 C	Zinc Rich Epoxy AMERCOAT 68-SERIES			75 micron	High Solid Aliphatic Polyurethane AMERSHIELD	100 micron	
						High Solid Epoxy NEOPLAST SG 31			160 micron		Polyurethane SF 11 / SF 12	80 micron
C5-I & M	in- & outdoor	Ambient up to 120 C	Zinc Rich Epoxy AMERCOAT 68-SERIES	75 micron	High Solid Aliphatic Polyurethane AMERSHIELD	125 micron						
			High Solid Epoxy NEOPLAST SG 31	160 micron		Polyurethane SF 11 / SF 12	80 micron					
Not Applicable	outdoor (visible surface)	Hot going equipm. with or w/o refractories, e.g. cyclones, ducts	< 200 C	Inorganic Zinc DIMETCOTE 9	65 micron	Inorganic Silica Amercoat 741 or Silicone Acryl Amercoat 891 <b>3)</b>  Inorganic Silica Amercoat 741 or Silicone <b>1)</b> Amercoat 878	125 micron 2* 25 micron maxim.					
		Hot going equipm. with or w/o refractories, e.g. cyclones, ducts	200 up tp 400 C	Inorganic Zinc DIMETCOTE 9	65 micron		125 micron 2* 25 micron maxim.					
Not Applicable	outdoor (non-visible surface)	Parts at cold end, e.g. Filters & ducts Insulated from outside	< 200 C	Modified Epoxy AMERCOAT 90S	150 micron	not required	-					
		Parts applied before waste heat utilisation, e.g. cyclones, ducts Insulated from outside	200 up to 400 C	Inorganic Zinc DIMETCOTE 9	65 micron	not required <b>2)</b> see footnote	-					
Not Applicable	Not Applicable	Machined surfaces which cannot be coated due to operation		Blank surface	Tectyl 846 or equivalent	-	Cleaning	not required	-			

Table 1: Surface Treatment Examples

DFT: Dry film thickness, Sa2.5: Sand blasting acc to ISO 8501-1, St.2: Rust removal acc. to ISO 8501-1

**Footnotes**

- 1) Curing temperature of Silicone is above 200°C.
- 2) To be prevented: rain water or condensation of water vapor, otherwise finish coat to be applied on visible surfaces
- 3) Amercoat 891 and 741 of Comp. Ameron (NL) are not suitable with Amercoat 90S, hence Dimetcote 9 required

5.3.2 Color Code for Finishing Painting

Object to be coated	Color	RAL No.
Steel structures, conveyor bridge	Squirrel grey	7000
Machinery platforms, landings	Squirrel grey	7000
Portal frames of buildings, doors, window frames	Squirrel grey	7000
Stairs, ladders, walk ways, platforms	Squirrel grey	7000
Piping supports, cable rack supports	Squirrel grey	7000
Duct supports	Squirrel grey	7000
Tunnel-and manhole- lid, trenches	Squirrel grey	7000
Hoist rails, maintenance beams	Squirrel grey	7000
Silos, feed bins, hoppers, chutes	Squirrel grey	7000
Pneumatic transport pipelines	Squirrel grey	7000
Hoists, cranes	Pastel yellow	1034
Maintenance devices	Pastel yellow	1034
Nuisance filters, fans, ducts	Sq.grey/light ivory	7000/1015
Firefighting Equipment	Tomato red	3013
Handrails, guards, buffer	Pastel yellow	1034
Belt conveyors, apron conveyors, weigh bridges, apron feeders, drag chains, elevators	Squirrel grey	7000
Motors, geared motors, gears	Squirrel grey	7000
Process filters w/o insulation	Squirrel grey	7000
Main process fans w/o insulation	Squirrel grey	7000
Kiln burners	Sq.grey/brilliant blue	7000/5007
Process filters, dedusting cyclones, fans, w/o insulation	Sq.grey/white alumin.	7000/9006
Waste gas ducts, stacks	White aluminum	9006
Preheater, precalciner	Sq.grey/white alumin.	7000/9006
Fresh water pipelines	Light green	6027
Treated water pipelines	Emerald green	6001
Industrial water tank	White aluminum	9006
Pumps, piping, armatures	Grass green	6010
Waste water: piping, armatures	Bottle green	6007
Compressor, receivers and piping for pressurized air	Brilliant blue	5007
Control air pipelines	Pastel blue	5024
Fuel oil (diesel) open air tank	White aluminum	9006
Pumps, piping, armature (ocher brown)	Brown	8001
Danger zones (striped)	Black/yellow	9005/1003

Table 2: Color Code for Finish Painting



#### 5.4 **Name Plates**



All name plates shall be made of corrosion resistant metal or Resopal®-type materials (min. 1.6 mm thickness). It shall be securely fitted to Equipment and it shall be clearly visible and easily readable. The following name plates are required:

- a) Instruction plates, to the extent necessary for safe operation, shall be in Contract Language and the preferred language of the Project Owner.
- b) Manufacturer's labels with typical technical data.
- c) Plate containing machine code (ACS) engraved according to the Plant Classification. Refer to paragraph 4.3.7 (Identification / Marking).

#### 5.5 **Special Tools**

- a) Special tools are uncommon tools and devices that cannot be purchased by the Project Owner as "normal" tools. Such tools are tailor-made- and supplied by the Contractor for special tasks required on- or operation and maintenance of any piece of Equipment.
- b) Special tools are considered part of Equipment and hence shall be supplied with Equipment. A list shall be provided with the equipment and identified to the Project Owner in writing. Such tools may be used during the erection of the Equipment, provided that these tools are handed over to the Project Owner undamaged after erection. Damaged tools shall be replaced immediately and free of charge to the Owner.

#### 5.6 **Bolts, Holding-Down Bolts and Base Plates**

All bolts, nuts, washers and securing devices shall be made of galvanized steel. Such items along with base plates, frames, anchoring-, fastening- and shimming materials as required for proper assembly and installation of Equipment shall be included and part of the relevant Equipment. This also refers to all foundation bolts and fastening devices required for the attachment of Equipment to steel structures or concrete foundations, as well as sliding rails for V-belt drives to be mounted on base plates.

#### 5.7 **Consumable Materials**

- a) All consumable materials (lubricants, hydraulic fluids) as required for flushing or for initial operation shall be included as per respective Contract document stipulation.
- b) The Project Owner will specify or approve in writing, the brands and types of auxiliary materials.

**5.8 Insulation and Cladding**

- a) The design of fixing, overlapping and sealing is subject to the Project Owner's written approval.
- b) The type and layer thickness of insulating material for Equipment and ductwork depend on the application. Refer to StDC part *Mechanical Equipment*.
- c) Cladding of insulating layers shall be made of aluminum or galvanized steel sheets of minimum thickness of respectively 0.75 mm or 0.63 mm. Profiled sheets may be used on large process filters and large ductwork. Particular attention to supports passing through cladding is required.

**5.9 Wear Parts and Wear Protection**

- a) All Equipment exposed to wear, shall be protected by high wear resistant materials of bolted replaceable design.
- b) Special attention is needed for access to- and handling of replaceable liners. The maximum weight and size for manual handling, as governed in the country of project execution strictly applies, however it shall not exceed 25 kg per piece.

**5.10 Vibration Prevention and Confinement**

- a) Machine vibrations are to be limited to acceptable levels by means of decoupling of foundations (where necessary) and sturdy design of building structures with due consideration of frequency / excitation aspects.
- b) Drive trains of main machinery (i.e. kiln, mills, process fans and blowers) shall be analyzed to ensure that operational speed do not coincide with natural frequency.
- c) Vibration sensors shall be provided for- and fitted to all Main Equipment subjected to material build-ups. This includes gearboxes for vertical mills and process fans.

**5.11 Instrumentation tabs and mounting flange**

Instrumentation tabs and mounting flanges as well as associated check and calibration tabs for process control Equipment shall be installed latest during erection in order to avoid damage to insulation and cladding after erection of the Plant.

**6. ENVIRONMENTAL ASPECTS**

**6.1 Particulate Emissions and Controls**

**6.1.1 Nuisance Dust Collection**

- a) Dust collectors or dust suppression Equipment shall be provided wherever needed, so that the Plant is visibly dust-free during operation. Related ductwork and chutes shall be skillfully designed and executed, with provisions for adjustment and fine-tuning. Particular attention shall be paid to the dedusting of:
  - Transfer points of conveying Equipment
  - Hoppers, bins, silos
  - Dust producing machinery
- b) The dust collector and suppression Equipment shall be designed to a clean air dust load of less than 30 mg/Nm<sup>3</sup> dry or according to Permits, whichever is more stringent.
- c) Venting ducts shall always be routed to the outside of buildings.

**6.1.2 Process Dust Collection**

The process dust collectors shall include the dust collectors for the kiln, the partial kiln gas extraction (bypass), the clinker cooler and all mills, and shall be designed to have a clean gas dust load less than 30 mg/Nm<sup>3</sup> dry or according to Permits, whichever is more stringent.

**6.1.3 Particulate Emission Monitoring**

In accordance with Permits, the stacks of process dust collectors shall have continuous monitoring. Such stacks are equipped with correctly located and dimensioned platforms.

Particulate Emission	Design Value [mg/Nm <sup>3</sup> , dry gas at 10% O <sub>2</sub> ]	Comments
Dust	≤30* and ≤Permit	Bag filters exclusively for kiln/raw mill/kiln bypass gas dedusting  Stacks of process dust collectors shall include continuous monitoring

\* 97% of the daily average values shall be within the Design Value

Table 3: Particulate Emission Monitoring

**6.2 Gaseous Emissions and Control**

The proposed kiln system shall be designed to be in compliance with the design values in the following table, or as imposed by the Permits, whichever is more stringent.

SO<sub>2</sub>, NO<sub>x</sub> and VOC emissions from the main stack are continuously measured and recorded. The stack is equipped with a correctly located and dimensioned platform. Values apply also to the weighted average of both stacks in case of a separate bypass stack.

Gaseous Emission	Design Value [mg/Nm <sup>3</sup> dry gas at 10% O <sub>2</sub> ]	Comments
SO <sub>2</sub>	≤400* and ≤Permit	Primary measures target < 200 mg/Nm <sup>3</sup> (Primary measures - raw material selection)  Abatement measures in difficult cases ≤400 <ul style="list-style-type: none"> <li>➤ Hydrated lime injection</li> <li>➤ Wet sulphur scrubbing</li> <li>➤ Other methods</li> </ul>
NO <sub>x</sub> (as NO <sub>2</sub> )	≤500* and ≤Permit	Target < 500 mg/Nm <sup>3</sup> (< 200 mg/Nm <sup>3</sup> as future target): <ul style="list-style-type: none"> <li>➤ Primary NO<sub>x</sub> reduction measures, and</li> <li>➤ SNCR</li> <li>➤ Other</li> </ul> Preheater/precalciner design shall allow future target < 200 mg/Nm <sup>3</sup>
VOC (as organic C)	≤100* and ≤Permit	Primary measures target << 100 mg/Nm <sup>3</sup> (Primary measures - raw material selection)
Benzene	≤5 and ≤Permit	Primary measures target << 5 mg/Nm <sup>3</sup> (Primary measures - raw material selection)
HCl	≤30 and ≤Permit	Primary measures target < 10 mg/Nm <sup>3</sup> (Primary measures – raw mat./fuel selection) Limit environmental impact and cyclone corrosion
NH <sub>3</sub>	≤30 and ≤Permit	Primary measures target < 30 mg/Nm <sup>3</sup> (Primary measures - raw material selection) Avoid detached plumes
Hg, Tl, Cd	≤0.03 (each) and ≤Permit	Target < 0.03 mg Hg/Nm <sup>3</sup> <ul style="list-style-type: none"> <li>➤ Primary measures (raw mat./fuel selection)</li> <li>➤ Low exhaust gas temperatures and dust-to-cement mill during direct operation (where feasible)</li> </ul>
Other 9 HM of European WID	≤0.5 (sum) and ≤Permit	“Other nine” include: As, Co, Cr, Cu, Mn, Ni, Pb, Sb, V
PCDD/DF	≤0.1 (ng TEQ/Nm <sup>3</sup> ) and ≤Permit	

\* 97% of the daily average values shall be within the Design Value

Table 4: Gaseous Emission Monitoring

### 6.3 **Noise Emission**



Noise emissions are to be kept to a minimum. Local and international limits shall not be exceeded. The following applies:

At **work places** the maximum level shall be less than 85 dB(A) at one meter from the emitting machine.

- a) At the closest point of the nearest living area outside the Plant the maximum level is 40 dB(A) at night and 55 dB(A) during the day (06:00 - 22:00).
- b) Where possible noise emission levels shall be in accordance with ISO standards 3744, 3746, 4871, 11201.

### 6.4 **Evidence of Environmental Protection Measures**

The Contractor shall provide a report with the final design of the Plant, documenting all measures taken to comply with the environmental requirements of the Permits.

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