

## Penguard Plus

### Product description

This is a two component amine cured high molecular weight epoxy coating. It is a fast drying, high solids, high build product. Specially designed as a universal, all round, new construction coating. Can be used as primer, mid coat, finish coat or as single coat system in atmospheric and immersed environments. Suitable for properly prepared carbon steel, stainless steel, aluminium, galvanised steel and thermally sprayed zinc substrates.

### Scope

The Application Guide offers product details and recommended practices for the use of this product.

The Application Guide (AG) must be read in conjunction with the relevant specification, Technical Data Sheet (TDS) and Safety Data Sheet (SDS) for all the products used as part of the coating system.

### Referred standards

Reference is generally made to ISO Standards. When using standards from other regions it is recommended to reference only one corresponding standard for the substrate being treated.

### Surface preparation

The required quality of surface preparation can vary depending on the area of use, expected durability and if applicable, project specification.

When preparing new surfaces, maintaining already coated surfaces or aged coatings it is necessary to remove all contamination that can interfere with coating adhesion, and prepare a sound substrate for the subsequent product. Inspect the surface for hydrocarbon and other contamination and if present, remove with an alkaline detergent. Agitate the surface to activate the cleaner and before it dries, wash the treated area using fresh water. Paint solvents (thinners) shall not be used for general degreasing or preparation of the surface for painting due to the risk of spreading dissolved hydrocarbon contamination. Paint thinners can be used to treat small localized areas of contamination such as marks from marker pens. Use clean, white cotton cloths that are turned and replaced often. Do not bundle used solvent saturated cloths. Place used cloths into water.

#### Process sequence

Surface preparation and coating should normally be commenced only after all welding, degreasing, removal of sharp edges, weld spatter and treatment of welds is complete. It is important that all hot work is completed before coating commences.

#### Soluble salts removal

Soluble salts have a negative impact on the coating systems performance, especially when immersed. Jotun's general recommendations for maximum soluble salts (sampled and measured as per ISO 8502-6 and -9) content on a surface are: For areas exposed to (ISO 12944-2): C1-C4: 200 mg/m<sup>2</sup> C5M or C5I: 100 mg/m<sup>2</sup> Im1-Im3: 80 mg/m<sup>2</sup>

#### Carbon steel

##### Initial rust grade

The steel shall be Rust Grade A or B (ISO 8501-1). For steel with Rust Grades C or D, contact your nearest Jotun office for advice.

##### Initial inspection and pretreatment

Inspect the surface for contaminations and if present, remove with an alkaline detergent. Agitate the surface to activate the cleaner and before it dries, wash the treated area by Low-Pressure Water Cleaning (LPWC) to Wa 1 (ISO 8501-4) using fresh water. Non-contaminated areas shall be washed down by Low-Pressure Water Cleaning (LPWC) to Wa 1 (ISO 8501-4) using fresh water to reduce the concentration of surface chlorides.

### Metal finishing

For areas in corrosivity category C1 to C4 (ISO 12944-2) all irregularities, burrs, slivers, slag and spatter on welds, sharp edges and corners shall conform to minimum grade P2 (ISO 8501-3) Table 1, or as specified. All edges shall have a rounded radius of minimum 2 mm subjected to three pass grinding or equally effective method. For areas in corrosivity category C5, Im1-3 the requirement is for the steel to conform to grade P2 (ISO 8501-3) Table 1. All edges shall have a rounded radius of minimum 2mm subjected to three pass grinding or equally effective method. One may use a mechanical grinder fitted with a suitable abrasive disc. All sharp irregularities, burrs, slivers, slag and spatter on welds, whether apparent before or after blast cleaning, shall be removed before coating application. It is recommended that welding smoke should be removed by low-pressure Water Cleaning LP WC method (ISO 8501-4:2006) Wa1 using fresh water. Welding smoke residues are water soluble and could cause blistering if not removed by washing before blasting. Defective welds shall be replaced and treated to an acceptable finish before painting. Temporary welds and brackets shall be ground to a flat finish after removal from the parent metal.

### Pitting repair

Pittings in steel can be difficult to cover fully with most coatings. In some areas it is practically feasible to use filler to fill pittings. This should then be done either after the initial surface preparation or after application of first coat.

## Abrasive blast cleaning

### Cleanliness

After pre-treatment is complete, the surface shall be dry abrasive blast cleaned to Sa 2½ (ISO 8501-1) using abrasive media suitable to achieve a sharp and angular surface profile.

### Surface profile

Recommended surface profile 30-85 µm, grade Fine to Medium G; Ry5 (ISO 8503- 2).

### Abrasive media quality

The selected abrasive must be compatible with both the surface to be blast cleaned and the specified coating system. The abrasive shall meet specifications as per relevant parts of ISO 11124 (Specification for metallic blast-cleaning abrasives), or ISO 11126 (Specification for non-metallic blast-cleaning abrasives). It should be sampled and tested as per relevant parts of ISO 11125 (metallic abrasives) or ISO 11127 (non-metallic abrasives). Dry storage of abrasive and shelter for blasting pots is necessary to prevent equipment becoming clogged with damp abrasive.

All abrasive blast media used should be new and not recirculated, with the exception of Steel Grit. If this is utilized the circulation process must include a cleaning process.

### Compressed air quality

The supply of clean air to blasting pots must be secured to avoid contamination of abrasive and thereby of blast cleaned surfaces. Compressors must be fitted with sufficient traps for oil and water. It is also recommended to fit two water separators at the blasting machine to ensure a supply of moisture-free air to the abrasive chamber.

### Dust contamination

At the completion of abrasive blasting the prepared surface shall be cleaned to remove residues of corrosion product and abrasive media and inspected for surface particulate contamination. Maximum contamination level is rating 2 (ISO 8502-3). Dust size no greater than class 2.

## Hand and Power Tool Cleaning

### Power tool cleaning

Minor areas of damaged coating may be prepared to St 2 (ISO 8501-1). Suitable method is disc grinding with rough discs only. Ensure the surface is free from mill scale, residual corrosion, failed coating and is suitable for painting. The surface should appear rough and mat. Overlapping zones to intact coating shall have all leading edges feathered back by sanding methods to remove all sharp leading edges and establish a smooth transition from the exposed substrate to the surrounding coating. Consecutive layers of coating shall be feathered to expose each layer and new coating shall always overlap to an abraded existing layer. Abrade intact coatings around the damaged areas for a minimum 100 mm to ensure a mat, rough surface profile, suitable for over coating.

### Water jetting

Not recommended

## Galvanised steel

### Abrasive blast cleaning

After removal of excess zinc and surface defects the area to be coated shall be degreased to ISO 12944-4, Part 6.1.4 Alkaline Cleaning. The galvanised surface shall be dry abrasive brush off blast cleaned with the nozzle angle at 45-60° from perpendicular at reduced nozzle pressure to create a sharp and angular surface profile using approved non-metallic abrasive media. As a guide, a surface profile 25-55 µm, grade Fine G; Ry5 (ISO 8503-2) should be achieved. Care must be exercised when sweep blasting. The zinc coating thickness should be reduced as little as possible, preferably not more than 10 µm. Smaller areas can be lightly treated with abrasive paper. Finished surfaces shall be dull, profiled and show no areas of shiny metal. Do not handle the prepared surface with bare hands.

### Hand and Power Tool Cleaning

After removal of excess zinc and surface defects the area to be coated shall be degreased with an alkaline detergent, washed by Low-Pressure Water Cleaning (LPWC) to a grade corresponding to the description of Wa 1 (ISO 8501-4) or higher standard and the surface abraded using mechanical or hand sanding methods using non-metallic abrasives or bonded fibre abrasive pads to remove all polish and to impart a scratch pattern to the surface. Do not use high speed rotational sanders.

### Water jetting

Inspect the surface for process residues, hydrocarbon contamination and corrosion by-products. If present, remove with an alkaline detergent. Agitate the surface to activate the detergent and before it dries, wash the treated area by Low-Pressure Water Cleaning (LPWC) to a grade corresponding to the description of Wa 1 (ISO 8501-4) or higher standard using fresh water.

## Aluminium

### Abrasive blast cleaning

After removal of surface defects the area to be coated shall be degreased to ISO 12944-4, Part 6.1.4 Alkaline Cleaning. The surface shall be dry abrasive brush off blast cleaned with the nozzle angle at 45-60° from perpendicular at reduced nozzle pressure to create a sharp and angular surface profile using approved non-metallic abrasive media. As a guide, a surface profile 25-55 µm, grade Fine G; Ry5 (ISO 8503-2) should be achieved. Alternatively refer to NACE no. 4/SSPC-SP7. Smaller areas can be lightly treated with abrasive paper. Finished surfaces shall be dull, profiled and show no areas of shiny metal. Do not handle the prepared surface with bare hands.

### Hand and Power Tool Cleaning

After removal of surface defects the area to be coated shall be degreased with an alkaline detergent, washed by Low-Pressure Water Cleaning (LPWC) to a grade corresponding to the description of Wa 1 (ISO 8501-4) or higher standard and the surface abraded using mechanical or hand sanding methods using non-metallic abrasives or bonded fibre abrasive pads to remove all polish and to impart a scratch pattern to the surface. Do not use high speed rotational sanders.

### Water jetting

Inspect the surface for process residues, hydrocarbon contamination and corrosion by-products. If present, remove with an alkaline detergent. Agitate the surface to activate the detergent and before it dries, wash the treated area by Low-Pressure Water Cleaning (LPWC) to a grade corresponding to the description of Wa 1 (ISO 8501-4) or higher standard using fresh water.

## Stainless steel

### Abrasive blast cleaning

After removal of surface defects the area to be coated shall be degreased to ISO 12944-4, Part 6.1.4 Alkaline Cleaning. The surface shall be dry abrasive brush off blast cleaned with the nozzle angle at 45-60° from perpendicular at reduced nozzle pressure to create a sharp and angular surface profile using approved non-metallic abrasive media. As a guide, a surface profile 25-55 µm, grade Fine G; Ry5 (ISO 8503-2) should be achieved. Alternatively refer to NACE no. 4/SSPC-SP7.

### Hand and Power Tool Cleaning

After removal of surface defects the area to be coated shall be degreased with an alkaline detergent, washed by Low-Pressure Water Cleaning (LPWC) to a grade corresponding to the description of Wa 1 (ISO 8501-4) or higher standard and the surface abraded using mechanical or hand sanding methods using non-metallic abrasives or bonded fibre abrasive pads to remove all polish and to impart a scratch pattern to the surface. Do not use high speed rotational sanders.

### Water jetting

Inspect the surface for process residues, hydrocarbon contamination and corrosion by-products. If present, remove with an alkaline detergent. Agitate the surface to activate the detergent and before it dries, wash the treated area by Low-Pressure Water Cleaning (LPWC) to a grade corresponding to the description of Wa 1 (ISO 8501-4) or higher standard using fresh water.

Chlorinated or chlorine containing solvents or detergents must not be used on stainless steel.

## Concrete

### Water cleaning

Low pressure water washing to a rough, clean, dry and laitance free surface.

## Coated surfaces

### Verification of existing coatings including primers

When the surface is an existing coating, verify with technical data sheet and application guide of the involved products, both over coatability and the given maximum over coating interval.

### Over coating

When applied on coatings past maximum intercoating interval light abrading may be required to achieve proper intercoat adhesion.

### Shop primers

Shop primers are accepted as temporary protection of steel plates and profiles. Refer to the technical data sheet for the generic types accepted. Certain standards require pre-approval of the shop primer as part of a complete system. Contact your nearest Jotun office for specific system compatibility. Before being overcoated the shop primer must be fully cured, clean, dust free, dry and undamaged. Inorganic zinc shop primers must be free of zinc salts (white rust). Corroded and damaged areas must be blast cleaned to minimum Sa 2½ (ISO 8501-1).

## Application

### Acceptable environmental conditions - before and during application

Before application, test the atmospheric conditions in the vicinity of the substrate for the dew formation according to ISO 8502-4.

#### Standard grade

Air temperature	5 - 50	°C
Substrate temperature	5 - 40	°C
Relative Humidity (RH)	10 - 85	%

The following restrictions must be observed:

- Only apply the coating when the substrate temperature is at least 3°C above the dew point
- Do not apply the coating if the substrate is wet or likely to become wet
- Do not apply the coating if the weather is clearly deteriorating or unfavourable for application or curing
- Do not apply the coating in high wind conditions

## Product mixing

### Product mixing ratio (by volume)

Penguard Plus Comp A	6	part(s)
Penguard Plus Comp B	1	part(s)

### Induction time and Pot life

Paint temperature	23 °C
Induction time	10 min
Pot life	1 h

The temperature of base and curing agent is recommended to be 18 °C or higher when the paint is mixed.

### Thinner/Cleaning solvent

Thinner: Jotun Thinner No. 17

## Application data

### Airless Spray Equipment

Pump ratio (minimum) :	42:1
Pump output (litres/minute) :	1.3-2.2
Pressure at nozzle (minimum) :	150 bar/2100 psi
Nozzle tip (inch/1000) :	17-23
Filters (mesh) :	70

Material hose length :



The consumption of paint should be controlled carefully, with thorough planning and a practical approach to reducing loss. Application of liquid coatings will result in some material loss. Understanding the ways that coating can be lost during the application process, and making appropriate changes, can help reducing material loss.

Some of the factors that can influence the loss of coating material are:

- type of spray gun/unit used
- air pressure used for airless pump or for atomization
- orifice size of the spray tip or nozzle
- fan width of the spray tip or nozzle
- the amount of thinner added
- the distance between spray gun and substrate
- the profile or surface roughness of the substrate. Higher profiles will lead to a higher "dead volume"
- the shape of the substrate target
- environmental conditions such as wind and air temperature

## Drying and Curing time

Substrate temperature	5 °C	10 °C	23 °C	40 °C
Surface (touch) dry	5 h	4 h	2 h	1 h
Walk-on-dry	16 h	10 h	6 h	3 h
Dried to over coat, minimum	9 h	7 h	6 h	3 h
Dried/cured for service	14 d	10 d	7 d	3 d

Drying and curing times are determined under controlled temperatures and relative humidity below 85%, and within the DFT range of the product.

Surface (touch) dry: The state of drying when slight pressure with a finger does not leave an imprint or reveal tackiness. Dry sand sprinkled on the surface can be brushed off without sticking to or causing damage to the surface.

Walk-on-dry: Minimum time before the coating can tolerate normal foot traffic without permanent marks, imprints or other physical damage.

Dried to over coat, minimum: The shortest time allowed before the next coat can be applied.

Dried/cured for service: Minimum time before the coating can be permanently exposed to the intended environment/medium.

## Maximum over coating intervals for atmospheric exposure

Substrate temperature	5 °C	10 °C	23 °C
Itself	3 mth	3 mth	2 mth
acrylic	3 mth	3 mth	2 mth
epoxy	7 d	7 d	5 d
polyurethane	7 d	7 d	5 d

## Maximum over coating intervals for immersed exposure

Substrate temperature	5 °C	10 °C	23 °C	40 °C
Itself	14 d	14 d	14 d	10 d

### Other conditions that can affect drying / curing / over coating

#### Adding anti-skid to the coating system

Anti skid aggregate should only be added in the final coat, and should not be used in single coat systems. Spread the aggregate evenly on the surface before half of time to Surface dry. Use Jotun Anti-skid, medium particle size (400 - 600 µm) for coatings applied in 150 to 400 µm DFT. The recommended usage is 2.5 - 3.3 kg per 10 litres of paint.

#### Repair of coating system

Damages to the coating layers:

Prepare the area through sandpapering or grinding, followed by thorough washing. When the surface is dry the coating may be over coated by itself or by another product, ref. original specification.

Always observe the maximum over coating intervals. If the maximum over coating interval is exceeded the surface should be carefully roughened in order to ensure good intercoat adhesion. Damages exposing bare substrate:

Remove all rust, loose paint, grease or other contaminants by spot abrasive blasting, mechanical grinding, water and/or solvent washing. Feather edges and roughen the overlap zone of surrounding intact coating. Apply the coating system specified for repair.

#### Repair of damaged areas

Sags and runs can be caused by too high wet film thickness, too much thinner added or the spray gun used too close to the surface.

Repair by using a paint brush to smooth the film when still wet.

Sand down to a rough, even surface and re-coat if the coating is cured. Orange peel can be caused by poor flow/levelling properties of the paint, poor atomization of the paint, thinner evaporating too fast or the spray gun held too close to the surface.

This can be rectified by abrading the surface and applying an additional coat after having adjusted the application properties or the application technique. Dry spray can be caused by poor atomization of the paint, spray gun held too far from the surface, high air temperature, thinner evaporating too fast or coating applied in windy conditions. Sand down to a rough even surface and re-coat. Pinholes can be caused by entrapped solvents in the film or by incorrect application technique.

Pinholes can be repaired as per procedure for damages to the coating layer or to the substrate, ref. above.

#### Coating film continuity

When required by the specification, the coating shall be tested for film discontinuity according to ASTM D 5162, test method A or B as appropriate for the actual dry film thickness.

All recorded defects shall be repaired by best practical means.

## Quality assurance

The following information is the minimum recommended. The specification may have additional requirements.

- Confirm all welding and other metal work, whether internal or external to the tank, has been completed before commencing pre-treatment and surface preparation of the substrate
- Confirm installed ventilation is balanced and has the capacity to deliver and maintain the RAQ
- Confirm the required surface preparation standard has been achieved and is held prior to coating application
- Confirm that the climatic conditions are within recommendation in the AG and held during the application
- Confirm the required number of stripe coats have been applied
- Confirm each coat meets the DFT requirements of the specification
- Confirm the coating has not been adversely affected by rain or any other agency during curing



- Observe adequate coverage has been achieved on corners, crevices, edges and surfaces where the spray gun cannot be positioned so that its spray impinges on the surface at 90°
- Observe the coating is free from defects, discontinuities, insects, spent abrasive media and other contamination
- Observe the coating is free from misses, sags, runs, wrinkles, fat edges, mud blistering, blistering, obvious pinholes, excessive dry spray, heavy brush marks and excessive film build
- Observe the uniformity and colour are satisfactory

All noted defects should be fully repaired to conform to the coating specification.

### Caution

This product is for professional use only. The applicators and operators shall be trained, experienced and have the capability and equipment to mix/stir and apply the coatings correctly and according to Jotun's technical documentation. Applicators and operators shall use appropriate personal protection equipment when using this product. This guideline is given based on the current knowledge of the product. Any suggested deviation to suit the site conditions shall be forwarded to the responsible Jotun representative for approval before commencing the work.

For further advice please contact your local Jotun office.

### Health and safety

Please observe the precautionary notices displayed on the container. Use under well ventilated conditions. Do not inhale spray mist. Avoid skin contact. Spillage on the skin should immediately be removed with suitable cleanser, soap and water. Eyes should be well flushed with water and medical attention sought immediately.

### Accuracy of information

Always refer to and use the current (last issued) version of the TDS, SDS and if available, the AG for this product. Always refer to and use the current (last issued) version of all International and Local Authority Standards referred to in the TDS, AG & SDS for this product.

### Colour variation

Some coatings used as the final coat may fade and chalk in time when exposed to sunlight and weathering effects. Coatings designed for high temperature service can undergo colour changes without affecting performance. Some slight colour variation can occur from batch to batch. When long term colour and gloss retention is required, please seek advice from your local Jotun office for assistance in selection of the most suitable top coat for the exposure conditions and durability requirements.

### Reference to related documents

The Application Guide (AG) must be read in conjunction with the relevant specification, Technical Data Sheet (TDS) and Safety Data Sheet (SDS) for all the products used as part of the coating system.

When applicable, refer to the separate application procedure for Jotun products that are approved to classification societies such as PSPC, IMO etc.

## Symbols and abbreviations

min = minutes

h = hours

d = days

°C = degree Celsius

° = unit of angle

µm = microns = micrometres

g/l = grams per litre

g/kg = grams per kilogram

m<sup>2</sup>/l = square metres per litre

mg/m<sup>2</sup> = milligrams per square metre

psi = unit of pressure, pounds/inch<sup>2</sup>

Bar = unit of pressure

RH = Relative humidity (% RH)

UV = Ultraviolet

TDS = Technical Data Sheet

AG = Application Guide

SDS = Safety Data Sheet

VOC = Volatile Organic Compound

MCI = Jotun Multi Colour Industry (tinted colour)

RAQ = Required air quantity

PPE = Personal Protective Equipment

EU = European Union

UK = United Kingdom

EPA = Environmental Protection Agency

ISO = International Standards Organisation

ASTM = American Society of Testing and Materials

AS/NZS = Australian/New Zealand Standards

NACE = National Association of Corrosion Engineers

DFT = dry film thickness  
WFT = wet film thickness

SSPC = The Society for Protective Coatings  
PSPC = Performance Standard for Protective Coatings  
IMO = International Maritime Organization

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## Disclaimer

The information in this document is given to the best of Jotun's knowledge, based on laboratory testing and practical experience. Jotun's products are considered as semi-finished goods and as such, products are often used under conditions beyond Jotun's control. Jotun cannot guarantee anything but the quality of the product itself. Minor product variations may be implemented in order to comply with local requirements. Jotun reserves the right to change the given data without further notice.

Users should always consult Jotun for specific guidance on the general suitability of this product for their needs and specific application practices.

If there is any inconsistency between different language issues of this document, the English (United Kingdom) version will prevail.

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