ZINGAMETALL

NACE Jubail Saudi Arabia Section

Wednesday, June 8th, Karan Hotel

www.zinga.eu

AMPP CHAPTER JUBAIL SAUDI ARABIA

Advanced Zinc Technology

for

Extending the Lifetime of Metallic Assets

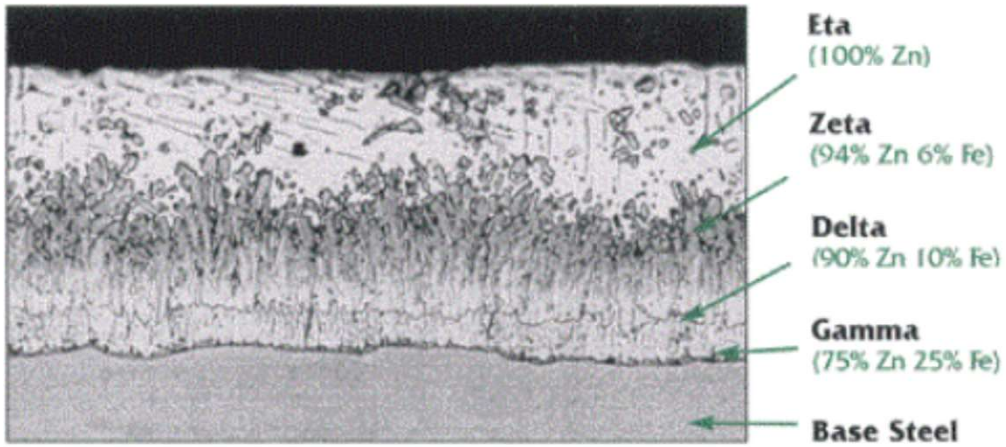
ZINGA

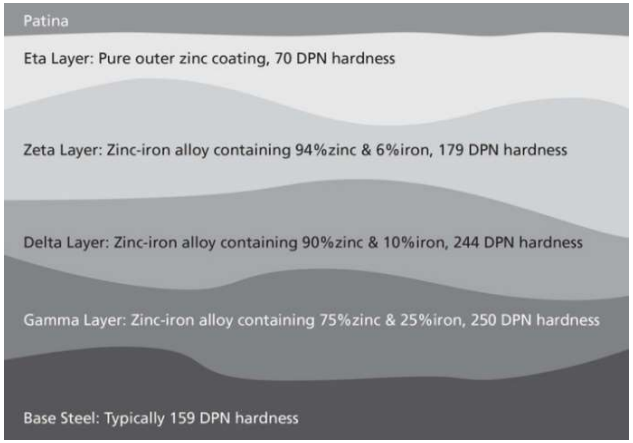
History of use - Background

- It seems to be a bitter irony that in order to protect a steel asset, the zinc layer must slowly destroy itself in the process, continuously depleting until there is no zinc left.

- This was until a Belgian chemist realised that HDG sadly has a finite life, albeit an extremely long life, and that eventually dismantling large assets for re-galvanising would be impractical, if not totally impossible, in the future.

- In the late 70's this chemist developped a totally unique zinc coating in order to be applied onto old or very weathered hot-dip galvanising (HDG) in order to prolong its service-life for another few decades.





History of use - Background

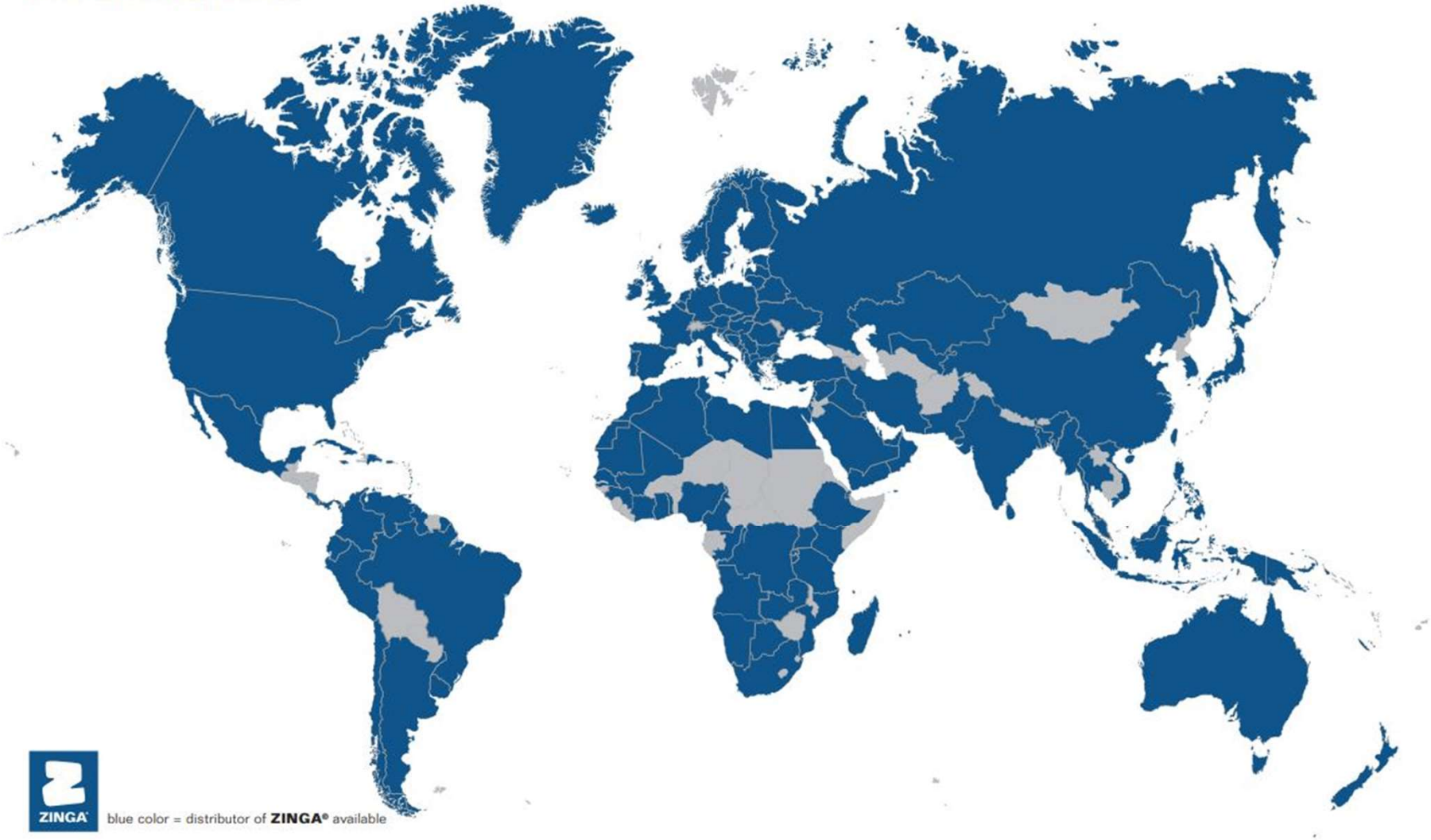
- His product was a purely “zinc on zinc” application, with no other chemicals or processes involved.
- This unique coating has a powerful synergy with HDG zinc, and it works in the exactly same way, depleting at varying microns per year, again depending on the geographical location of the asset.
- Like HDG, this coating had to contain a very high level of metallic zinc, and these particles had to have an extremely high level of purity.
- He called it ZINGA (as a reference to ZINc GAlvanizing), and he started producing it in his garage and selling it in 1980. The ZINGAMETALL company was created in 1981.
- *(details of ZINGA in slide 11 and further)*

ZINGA

History of use - Background

- ZINGA has been in successful use for over 40 years worldwide
- On many occasions ZINGA has re-loaded the hot-dip galvanising on old structures
- ZINGA is used on new steel or iron structures that will not fit inside HDG dip-tanks
- ZINGA behaves like hot-dip galvanising and sacrifices itself to protect the steel
- The system is known as “Film Galvanising” as it is applied onto steel as a film
- It is the only system used to galvanise aluminium in bolted dissimilar joints

THROUGH A NETWORK OF DISTRIBUTORS, ZINGAMETALL MAKES ITS RANGE OF PRODUCTS AVAILABLE WORLDWIDE.



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blue color = distributor of **ZINGA®** available

Example: Combining the advantages of both systems – HDG & ZINGA

20-ton box-beams used to build Runcorn Power Station in UK
Combination of HDG and ZINGA on same project !

Example: Retro-galvanising major components on offshore structures






Before **After (2013)** **Inspection in 2019**

OMV Rompetrol Oil Platform, Black Sea, Romania

ZINGA

Example: Retro-galvanising major components on onshore structures

During & after application

After 15 years of exposure

(some rust stains coming from non Zinga coated rails)

Storage Tank no. 308 Exxon Mobil Refinery, Southampton, England

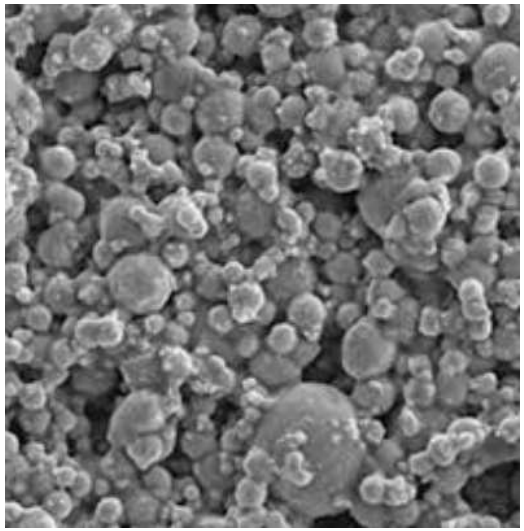
Example: Retro-galvanising 309 pier legs inside a harbour splash-zone

Newly galvanised pier legs

Inspected after UHP water-jetting of algae & barnacles after 15 years

Film Galvanised pier legs in Killybegs, County Donegal, Ireland.
The pier legs are located under a big fish farm.

Zinc particles:



- The dried zinc layer contains 96% zinc particles.
  The zinc particles are atomised (not distilled), giving it an additional benefit of having more contact between the particles and thus more conductivity from the top layer to the steel.
- The zinc particles contain 97% pure zinc and the remainder is oxides
- The zinc particles have a purity of 99.995%
- Like HDG it's surface forms an oxide patination and also forms carbonates
- After a few days it also starts building layers of simonkolleite platelets

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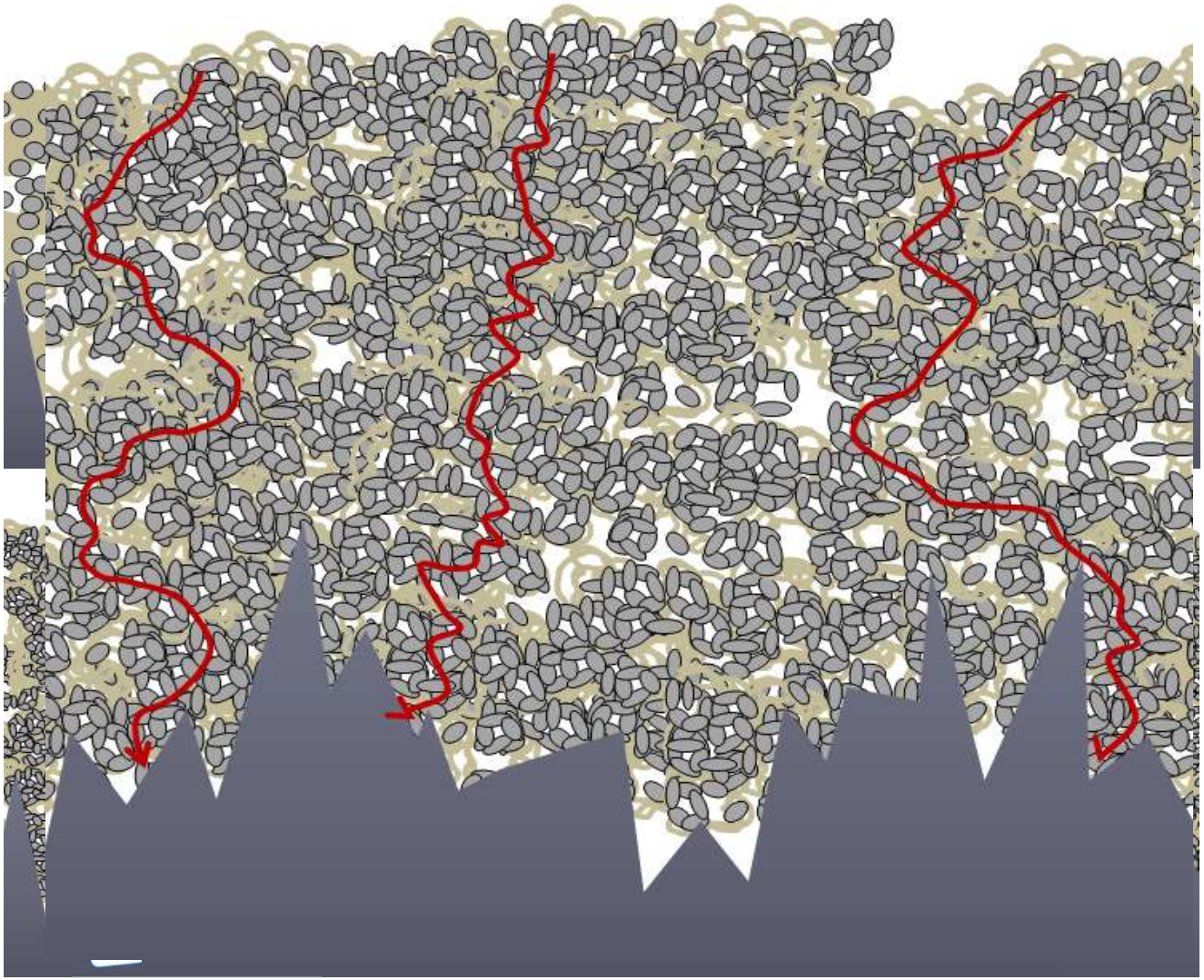
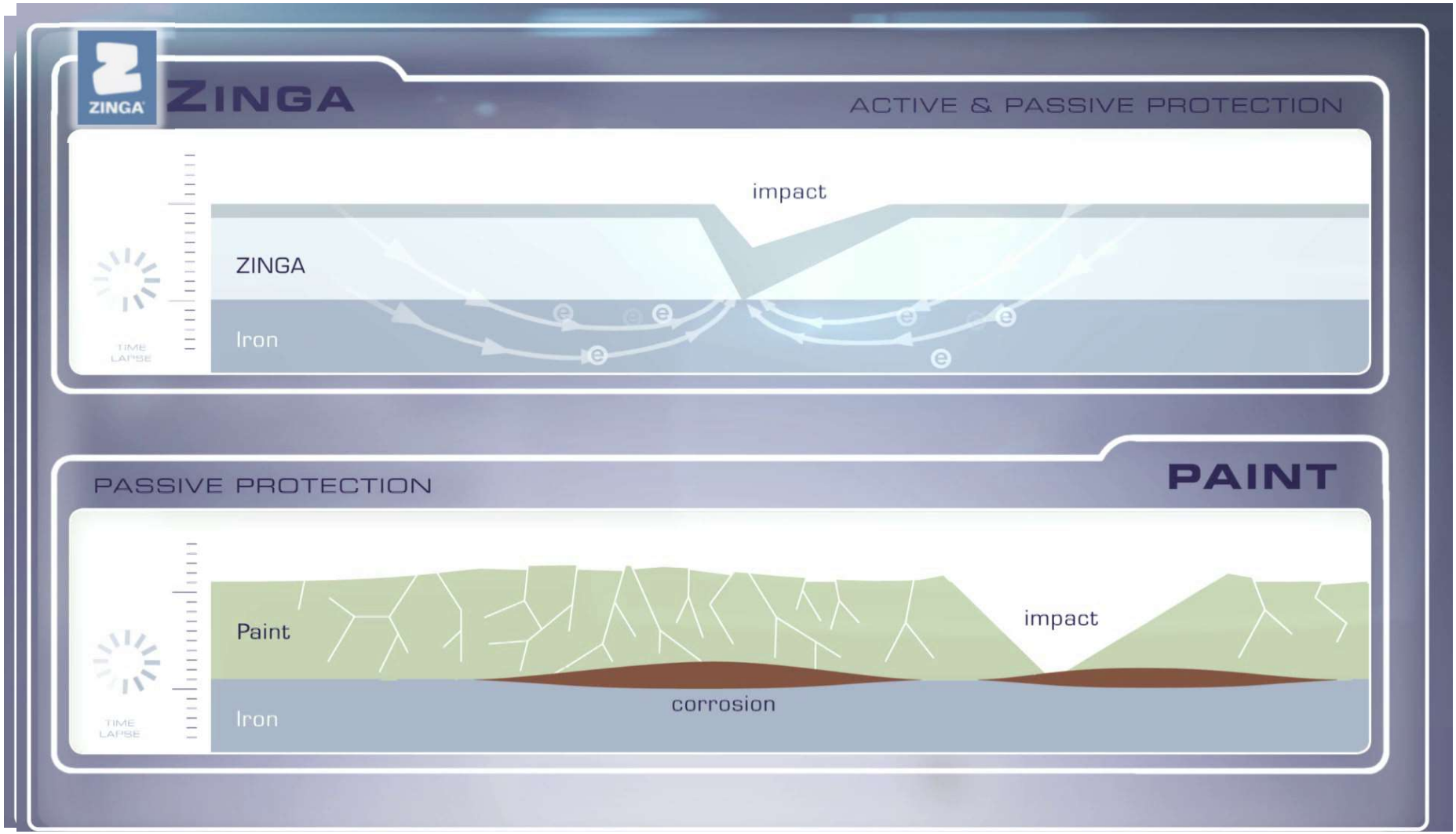
Zinc particles: ZINGA vs Zinc-rich paint



ZINGA

Working principle of Film Galvanising system



Dynamic adhesion values:

- The initial adhesion values when measured after one week of exterior exposure to weather is normally above 6.0 MPa.
- After three or four months this value will increase to around 9.0 MPa
- After nine months the adhesion-value increases to 11.0 MPa
- This value can remain constant for the next 30 years

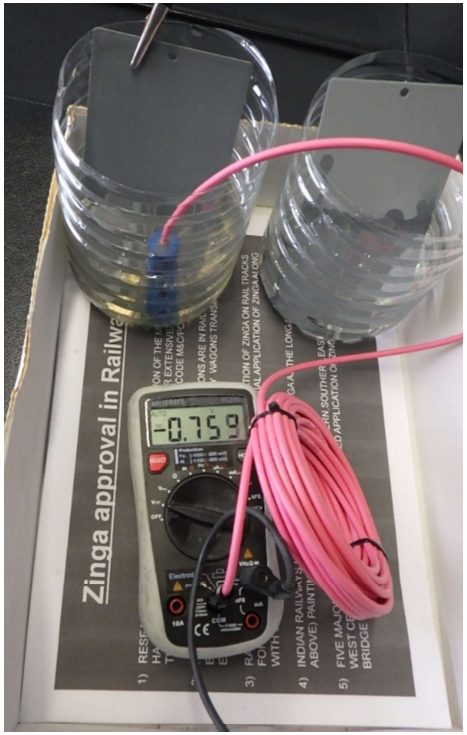
ZINGA

Electrical Potentials

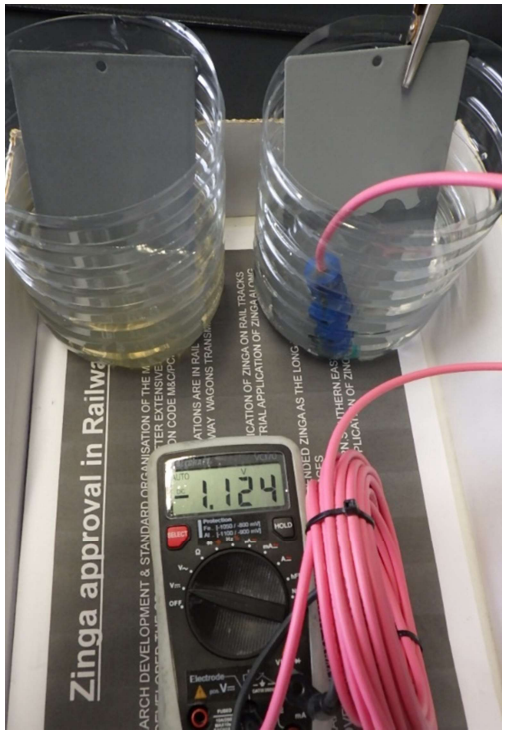
- Zinga generates an electrical potential of -1100 mV.

  (minimum – 840 mV is necessary to have cathodic protection)

- This is an ‘open circuit’ voltage that is measured on a coated steel panel.
- The coating has a ‘throw’ of 15mm (linear polarisation) to protect ‘open’ steel.
- Steel that has ‘misses’ or ‘holidays’ cannot corrode due to the ‘throw’.

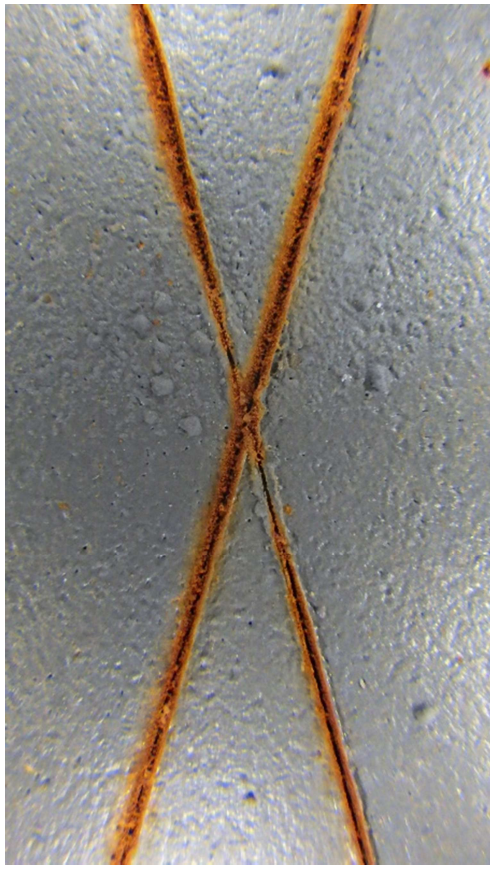


Other “zinc spray”



ZINGASPRAY

The ‘throw’ of the zinc layer:



“Zinc-rich” paint

ZINGA

X-cut test:

After 7 days immersion in 3% salt water, the ‘throw’ of ZINGA is clearly working extremely well.

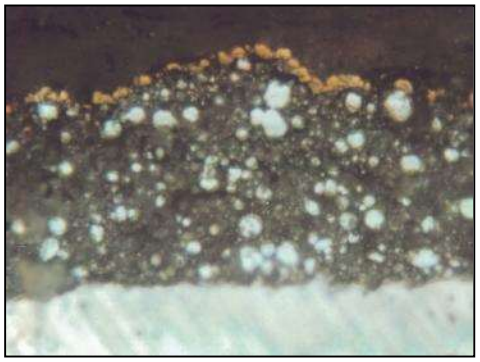
The ‘throw’ is another term for the strength of linear polarisation of the steel by the zinc layer.

Zinga can ‘throw’ up to 15mm in the same manner as HDG, and can ‘throw’ under marine immersion up to three metres in the same manner as a zinc anode

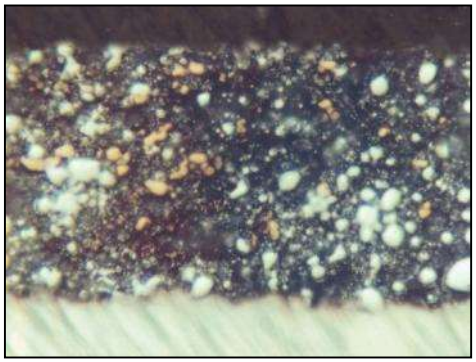
Advantages

- Galvanised structures can be ***recharged or reloaded*** with ZINGA
  - ZINGA on ZINGA
  - ZINGA on Metallised or HDG

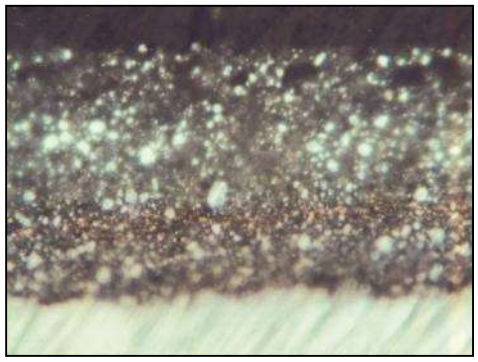
- Each new layer of ZINGA blends perfectly with the previous one.
  Additional layers all blend to **<u>one single, homogeneous ZINGA layer</u>**



Gold particles on top of ZINGA



Application of 2nd pass ZINGA
on gold particles ;
The gold particles blended
in the two layers of ZINGA



Gold particles in between
the two layers of epoxy paint.
Epoxy does not blend together !

ISO 12944 testing:

Zinga has been tested by third-party laboratories to the following standards :

a.ISO 12944 - C4 (High) & C5 (Medium) for ZINGA 80 – 100 µm DFT

b.ISO 12944 - C5 (Very High) for ZINGA 120 µm DFT

c.ISO 12944 – CX for ZINGA 120 µm DFT

d.ISO 12944 – IM4 for ZINGA 120 µm DFT

e.ISO 12944 – IM2 & IM3 for ZINGA 120 µm DFT

and **NORSOK M-501 testing:** Passed test for Systems 1 & 7 (@ 120 µm DFT)

and **MIC Resistance** (resistant to Microbial Induced Corrosion)

and passed the **NSF/ANSI/CAN 61** test for use in contact with potable water

and several other national & international tests (fire propagation, reaction to fire, slip & friction coefficient, undercreep corrosion, cleave adhesion, pull out, welding, …)

Overview of advantages of the coating

- One component (1-pack) – no mixing of A & B components (= time saving)
- Up to +25 years performance warranty against corrosion (@ 120µ DFT)

  (external lab tested acc. ISO 12944-6 in C5-VERY HIGH environment)
- Can be directly topcoated with ZINGA, and in short period with 2-comp. PU, EP or Acrylics (time saving)
- Very fast drying time (touch dry in 10 min @ 20°C = time saving)
- Is a reversible coating (can be indefinitely recharged / reloaded at low cost)
- Unlimited shelf life and almost unlimited pot life (= no waste)
- Can be used as stand-alone system or as primer in traditional coating systems
- Does not contain toxic or carcinogenic solvents (Green Label in Singapore)
- Can be used under water or in contact with potable water (NSF 61 Certificate)
- Is resistant to MIC – Microbial Influenced Corrosion – (ENDURES NL tested)
- Will take any impact and never crack or flake off (at right min. DFT)
- Can work down to -40°C and up to +120°C (with +150°C peaks)
- Can be applied in heavy weather conditions & up to 95% RH
- Can replace, repair or build-up Hot Dip Galvanising and Zinc Thermal Spray
- Less burn-back during welding ; no undercreep corrosion after mechanical damages

ZINGA

Advantages of the coating:

- Reduced layer thickness for equal protection = reduced application costs
  - ISO 12944 tested: resistance in C5 – VERY HIGH enironment
  - Comparable resistance from traditional systems (acc. ISO 12944):

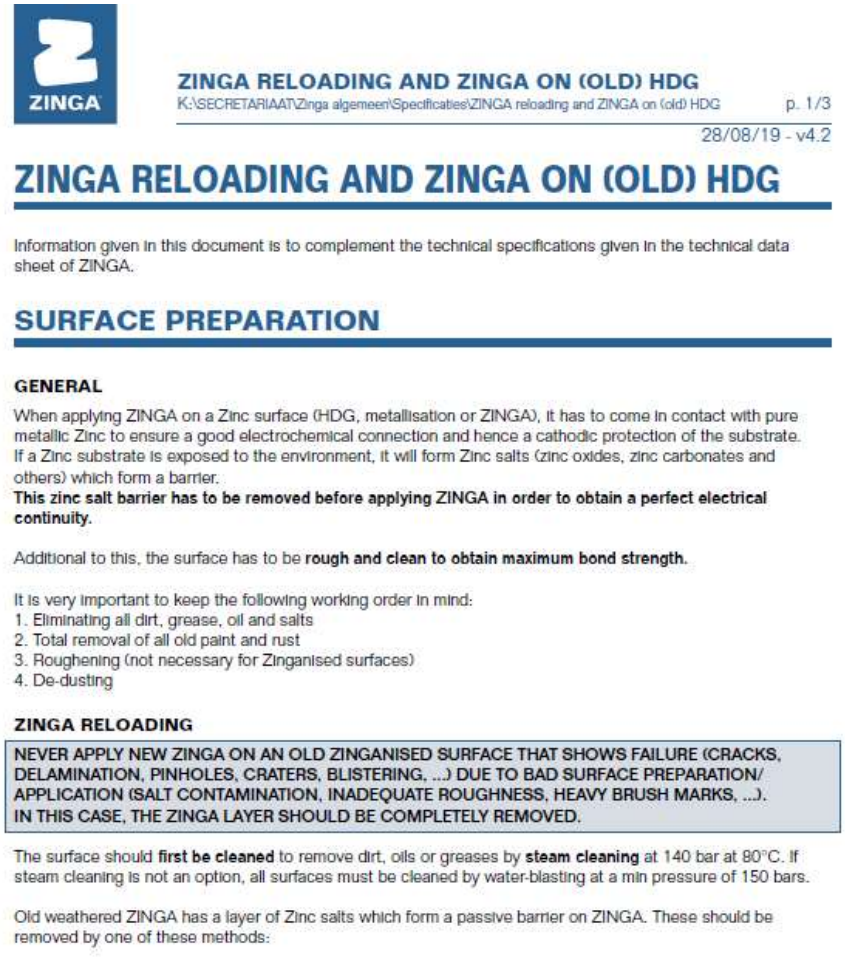
ZINGA system	Metallisation	Hot-dip	Paints
ZINGA	Metallisation (Zn) 100 µm	Hot-dip 80 µm	Zn-Epoxy / PUR
ZINGA	Epoxy tie-coat	Epoxy / PUR	Epoxy / PUR
	Epoxy / PUR	Epoxy / PUR	Epoxy / PUR
	Epoxy / PUR	(Epoxy / PUR)	Epoxy / PUR
120 - 150 µm	**340 µm**	**320 µm**	**360 µm**
< 1 day	**Min. 3 days**	**Min. 3-4 days**	**Min. 3 days**

- This means that 2 coats of ZINGA with a total of 120-150 µm DFT gives a **performance equivalent to a 320 to 360 µm DFT traditional coating system !**
- **ZINGA can be applied in less than 1 day = less shutdown costs !**

Surface Preparation – HDG / TSZ-TSA

ZINGAMETALL's recommendations for are in line with ASTM A-780:
Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

For TSZ/TSA similar surface preparation is needed (for refurbishment purposes)



ZINGA

ZINGA RELOADING AND ZINGA ON (OLD) HDG
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28/08/19 - v4.2

ZINGA RELOADING AND ZINGA ON (OLD) HDG

Information given in this document is to complement the technical specifications given in the technical data sheet of ZINGA.

SURFACE PREPARATION

GENERAL

When applying ZINGA on a Zinc surface (HDG, metallisation or ZINGA), it has to come in contact with pure metallic Zinc to ensure a good electrochemical connection and hence a cathodic protection of the substrate. If a Zinc substrate is exposed to the environment, it will form Zinc salts (zinc oxides, zinc carbonates and others) which form a barrier.
This zinc salt barrier has to be removed before applying ZINGA in order to obtain a perfect electrical continuity.

Additional to this, the surface has to be **rough and clean to obtain maximum bond strength.**

It is very important to keep the following working order in mind:
1. Eliminating all dirt, grease, oil and salts
2. Total removal of all old paint and rust
3. Roughening (not necessary for Zinganised surfaces)
4. De-dusting

ZINGA RELOADING

NEVER APPLY NEW ZINGA ON AN OLD ZINGANISED SURFACE THAT SHOWS FAILURE (CRACKS, DELAMINATION, PINHOLES, CRATERS, BLISTERING, ...) DUE TO BAD SURFACE PREPARATION/ APPLICATION (SALT CONTAMINATION, INADEQUATE ROUGHNESS, HEAVY BRUSH MARKS, ...).
IN THIS CASE, THE ZINGA LAYER SHOULD BE COMPLETELY REMOVED.

The surface should **first be cleaned** to remove dirt, oils or greases by **steam cleaning** at 140 bar at 80°C. If steam cleaning is not an option, all surfaces must be cleaned by water-blasting at a min pressure of 150 bars.

Old weathered ZINGA has a layer of Zinc salts which form a passive barrier on ZINGA. These should be removed by one of these methods:

Preparation of the steel surface:

Optimal general surface preparation sequence:

1. Degrease SSPC – SP1
2. Blast-clean Sa 2.5 / NACE 2 / SSPC – SP10
3. De-dusting ISO 8502 - 3
4. Stripe coat all sharp edges, inside angles, bolt-heads, crevice-joints and etc
5. Full-coat all surfaces, completely overlapping all stripe-coats to ensure full DFT's.

Note: On marine steelwork a Bresle test is caried out to ISO 8502 - 6

ZINGA Front Line Maintenance Program

ZINGA

Front Line Maintenance Program

- This method of surface preparation is used on onshore and offshore structures
- Blast-cleaning and power-tool cleaning is strictly forbidden in these areas (sparks)
- The asset-owners have limited time and manpower to accomplish the maintenance
- The asset-owners usually require up to 3 to 5 years of corrosion-protection
- The asset owners do not want any extraneous equipment on board their platforms
- The asset-owners do not want any power-tools or equipment inside their refineries

Front Line Maintenance Program – Surface preparation

Mechanical tool or wire brush

- SSPC SP2 / SP3 / SP11 (ISO 8503-1 St2 / St3)
- Used as offshore asset protection

Typical Heavy Corrosion Spots

ZINGA

Front Line Maintenance Program

Treating corrosion just using a wire brush and an aerosol spray = min. 3 years protection

Before ZINGA treatment

After ZINGA treatment

Front Line Maintenance Program




Front Line Maintenance Program

Critical components like valves can be treated safely and with total confidence

Before ZINGA treatment

After ZINGA treatment

Front Line Maintenance Program

Treating corrosion just using a wire brush and an aerosol spray = min. 3 years protection

Before ZINGA treatment

After ZINGA treatment

Front Line Maintenance Program

How does ZINGA work so well on corroded steel?

- The surface (powdery orange-coloured) rust is removed using a wire brush
- This is a newer rust formation (Fe_2O_3) and comes away quite easily.
- This leaves behind the more solid brown-coloured rust (Fe_3O_4)
- Rust particles vary between 5µm and 20µm in size within a rust matrix
- ZINGA particles vary between 1µm and 6µm in size
- Zinga particles can penetrate inside a rust layer and obtain a very high bond-strength
- The zinc particles will encapsulate rust particles on the outer surface of the matrix

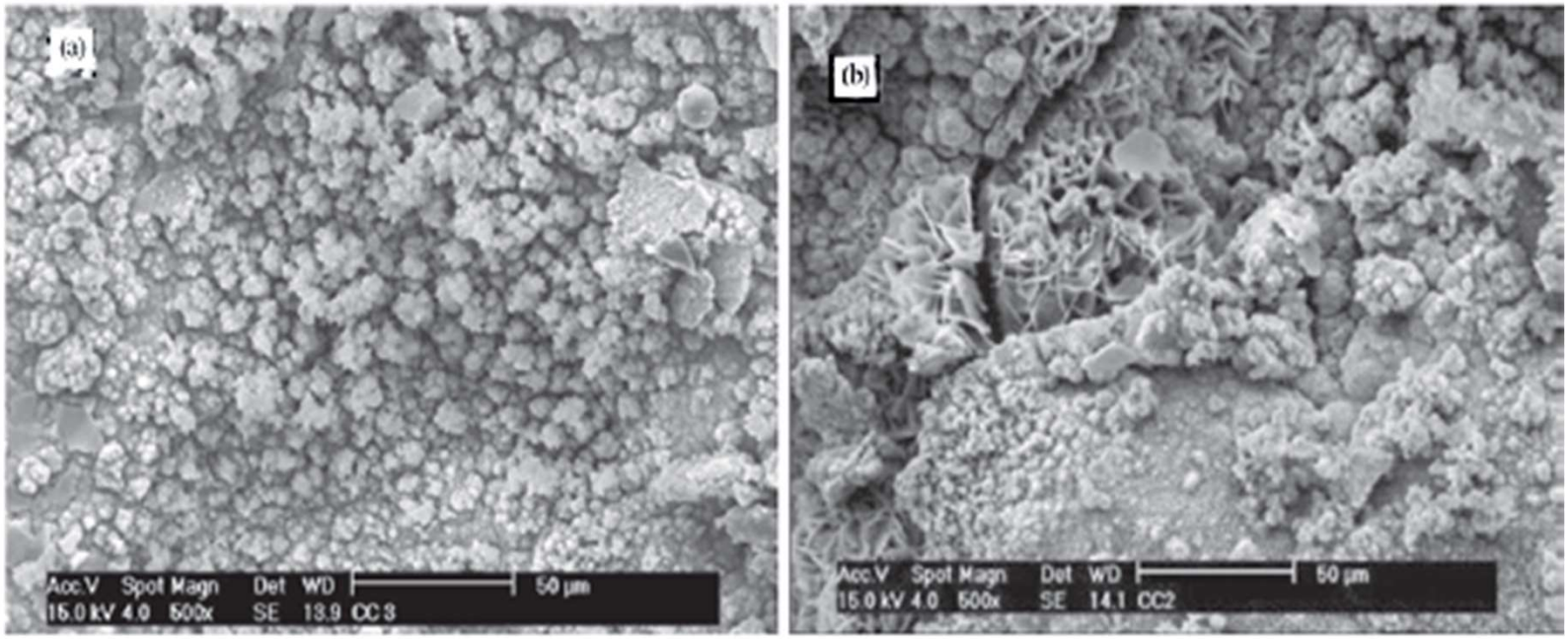
Front Line Maintenance Program

How strong is the adhesion to a corroded steel surface?

- In the Exxon Mobil Oil Refinery (Malaysia) they measured 12.2 MPa pull-off values!!
- The heavily (and naturally) rusted steel panels were weathered for seven days after application of the ZINGA by aerosol spray.
- During this time they were fully exposed to rain and overnight condensation.
- All testing was carried out by Exxon Mobil corrosion engineers, and they issued a formal signed-off report on this testing.
- Since then it has been used on their offshore oil platforms and refineries

Front Line Maintenance Program

Corrosion x-rays showing growth stages and why ZINGA can penetrate inside



These x-rays are showing a span of approximately 200 µm in a linear section

Front Line Maintenance Program - Specification

ZINGA 150 µm – Off Shore	ZM 150 µm

Scope:

Material:	Carbon steel	**Exposure category**	CX
Environment:	Off Shore	**Standard**	ISO 12944-6:2018

Surface Preparation:

Surface Pre-preparation:	Degrease by freshwater jetting at 150 bars in comb. with cleaner or by freshwater jetting at 700 bars	
Surface Cleanliness:	Blast cleaning to SA 2.5	ISO 8501:2007
Surface Profile:	Medium G R_{y5}	ISO 8503:2017
Surface Salt Levels:	≤ 50 mg/m²	ISO 8502:2017
Surface Dedusting	≤ Class 2	ISO 8502-3

System A: Zinga Unique

Product	*Application Type*	*Volume Solids (%)*	*Required DFT (µm)*	*Indicated WFT undiluted (µm)*	*Theoretical Spreading Rate (m²/kg)*	*Application Method*	*Solvent*	*Overcoat Time after touch dry (Hrs)*		
								10°C	*15°C*	*20°C*
ZINGA	**S/C + F/C**	**58**	**150***	**260*****	**1.8**	**A / S / B****	**Zingasolv**	**2.0**	**1.5**	**1.0**

**Application in maximum 2 layers*
***For stripe coating only round brush*
****WFT is depending on dilution rate*

*Application Type Key: **M/C** = Mist Coat, **F/C** = Full Coat, **S/C** = Stripe Coat*
*Application Method Key: **A** = Airless Spray, **S** = Conventional Spray, **R** = Roller, **B** = Brush*

Front Line Maintenance Program - Specification

ZINGA 150 µm – Off Shore	ZM 150 µm

Notes on this Specification:

1. **General:**

   a. Please use this specification in conjunction with the appropriate Technical Data Sheets and MSDS.

   b. Application Conditions: please see the Technical Data Sheet for details of minimum temperatures, humidity etc. For optimum performance the surface should be completely dry and the **Sa 2.5 cleanliness** standard strictly adhered to.

   c. All surfaces to be coated must be thoroughly cleaned and degreased as per above in the 'Surface Preparation' table and clause 2.

   d. To obtain the optimum performance and protection levels, the surface must be completely dry and it must have the minimum degree of cleanliness of SA 2.5 / SSPC-SP10 / NACE 2 within the blast-profile range of R_{y5} Medium G.

   e. All surfaces shall be prepared in accordance with ISO 8501-3 Table 1, minimum P2. **All sharp edges must be radiused to a minimum of 2 - 3 mm prior to any blasting work**. This is considered as 'best practice' on all steel work.

   f. A Bresle test must be conducted to ensure the levels are below 50 mg/m².

   g. Drying times will be affected by temperatures, humidity and ventilation conditions.

   h. Measurements of DFT should only be taken when the coating is fully cured, as false readings can be experienced.

   i. The above tables for coverage etc. are for guidance only.

   j. A report of atmospheric conditions during application, indicating steel temperature, ambient temperature, dew temperature and humidity will be included in the final report.

2. **Pre-cleaning:**

   a. All steel surfaces must be cleaned prior to blasting. This can be done either by fresh waterjetting at a pressure of minimum 700 bars (70 MPa) or freshwater cleaning at minimum 150 bars (15 MPa) in combination with a cleaner (detergent). Optional, a salt remover e.g. CHLOR*RID® or HoldTight can be added to the cleaning water.

ZINGA Frontline

MAINTENANCE
PROGRAM

These companies are using the maintenance program on their oil platforms - increasingly!

The platforms are all located in Asia, in the East & West Malaysia areas, but also on onshore petrochemical plants in various countries.

In tropical, highly corrosive areas!

ExxonMobil

REPSOL

PETRONAS

ConocoPhillips

CARIGALI HESS
CARIGALI HESS OPERATING COMPANY SDN BHD

Chevron

ZINGA

Companies

- Approval by CFE - Comisión Federal de Electricidad (Mexico)
- Approval by LAND ROVER (UK)
- Supplier of PETROBRAS (Brazil)
- Supplier of PETRONAS (Malaysia)
- Supplier of SHELL (Brunei)
- Supplier of ExxonMobil (Malaysia)
- Supplier of S.W.C.C. (Saudi Arabia)

CFE Comisión Federal de Electricidad

LAND ROVER

BR PETROBRAS

PETRONAS

BRUNEI

ExxonMobil Energy lives here™

المؤسسة العامة لتحلية المياه المالحة
Saline Water Conversion Corporation

AND BY MANY OTHER COMPANIES WORLDWIDE

Thank you for your attention!
Questions?