

De Nora's Value-added Coatings for Chlor-Alkali & Safe Solutions to Chlorine gas feeding for Water treatment

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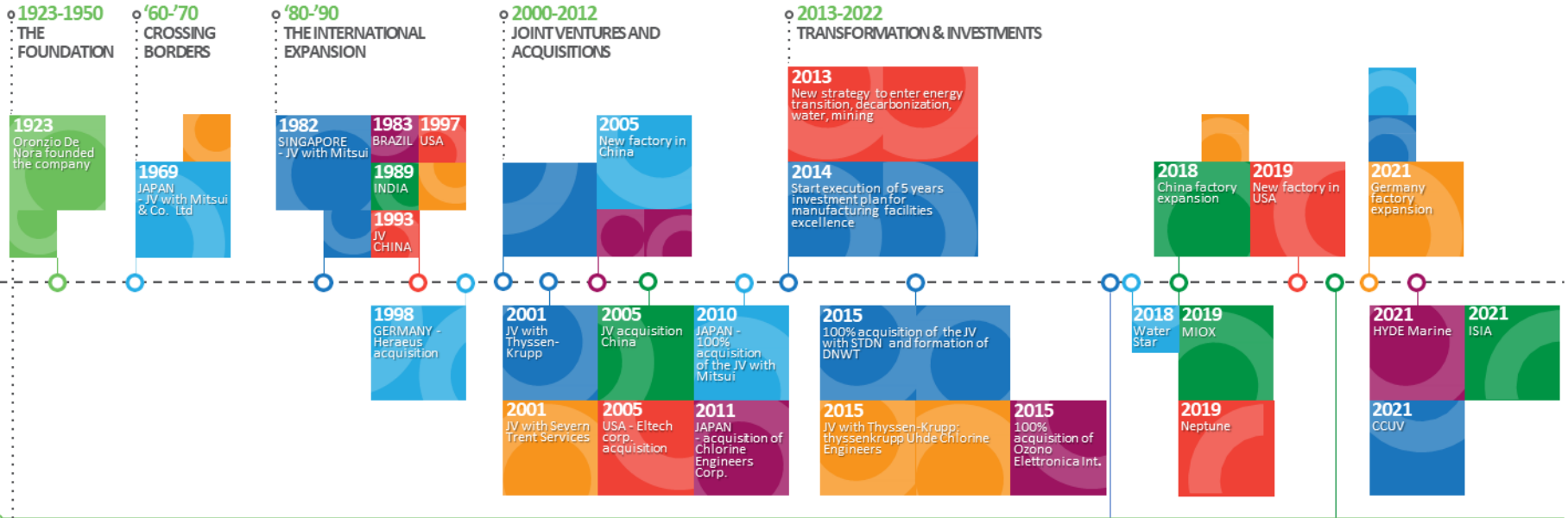


CloroSur
2022

COSTA DO SAUÍPE

De Nora – Heritage founded on entrepreneurialism and innovation

ENTREPRENEURIAL GROWTH

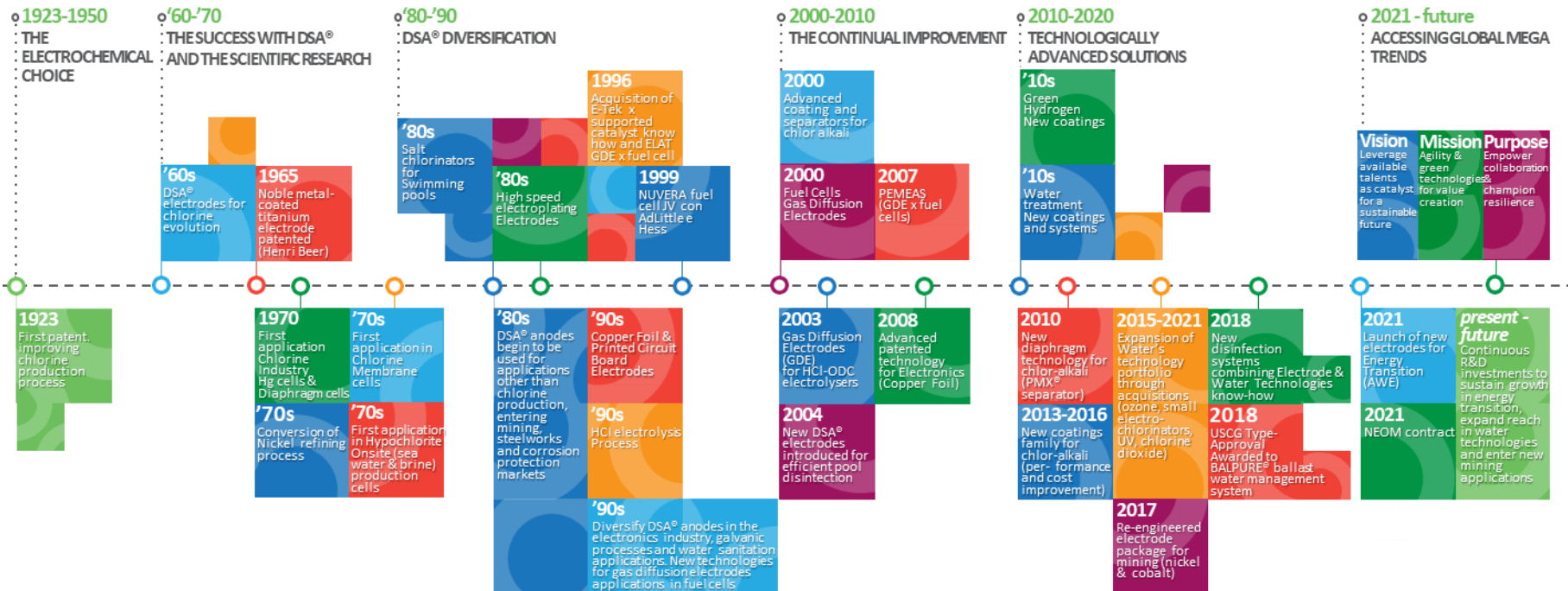


SHAREHOLDERS

1923-2017
100% DENORA FAMILY



TECHNOLOGICAL AND INNOVATIVE EVOLUTION



DE NORA GROUP SERVICE



Renewed anode coating family

To meet the growing challenging requirements of today's Chlor-Alkali Industry De Nora has focused its effort on the complete renewal of its anode coating portfolio.

This has brought to the development of a new generation of anode coating formulations results of the combination of the following unique features:

- De Nora "Continuous Development" Concept.
- De Nora Know-how accumulated over the years.
- Proprietary chemistry of improved metal complexes.
- Skilful use of metalloids.
- Sophisticated layer architecture.
- Status of the art application procedure

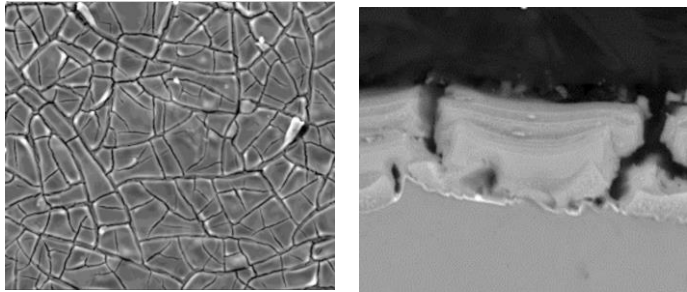
Continuous Improvement and know-how

Optimization of NM elements combine with same or better level of performance was allowed by combination of different parameters:

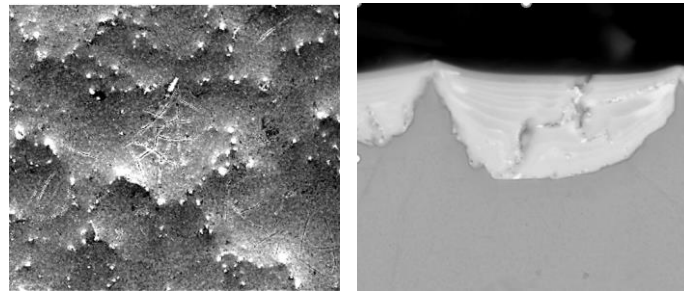
- selected use of valve metals and their combination in the coating matrix have been exploited in the coating **Composition**
- New precursors allow coating **Morphologies** unknown until some year ago
- New concepts on coating **Architecture** have been explored
- Tune up of **Manufacturing** aspects

This coupled with deeply-rooted know-how coming from decades of experience and enriched by several acquisitions brings to new anode coating family

Historical one



New family



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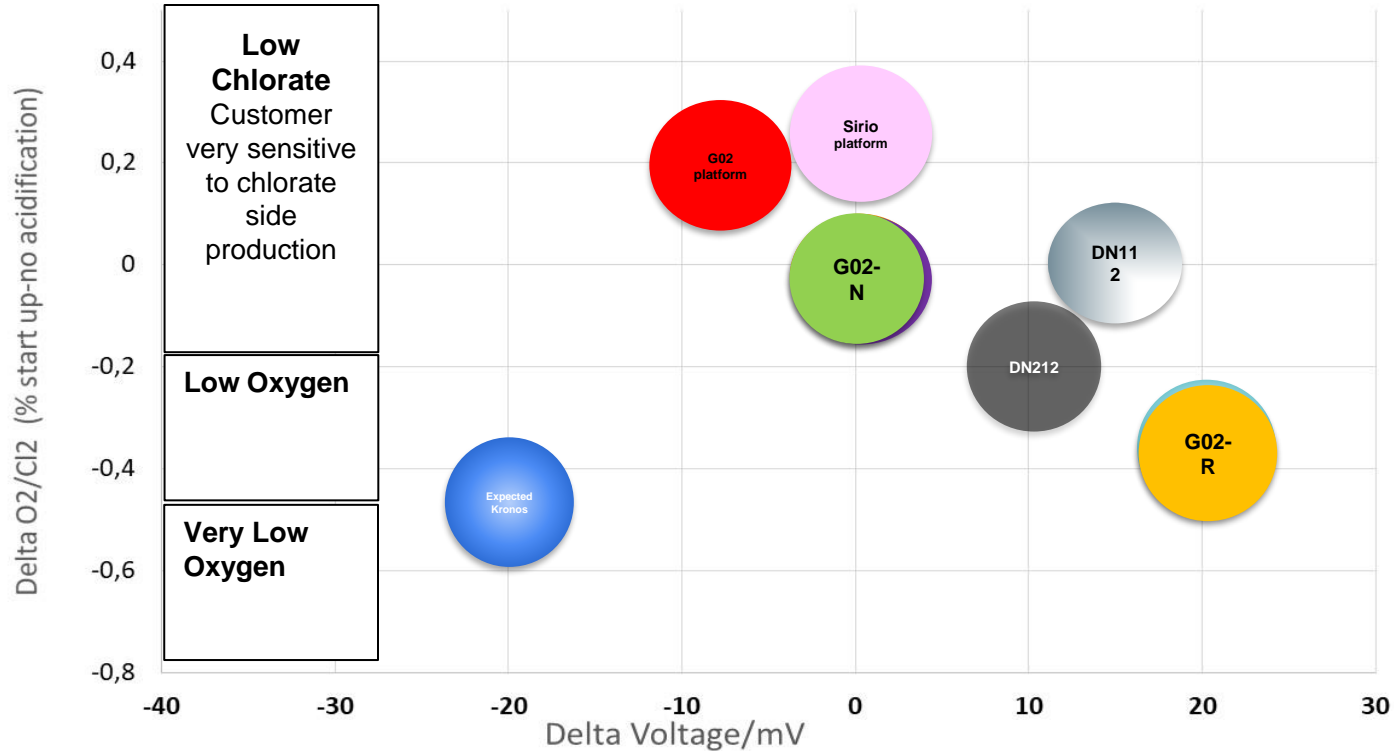
New anode coatings

- The new anode coating generation started with:
 - **Sirio family:** best trade off between cost and performances specifically designed to address the China market very high competitiveness
 - **GO2 platform:** new flagship platform designed to have similar voltage performance of the traditional “low chlorate” coatings with a reduced cost and high resilience to NM price variations.
 - **LZM+:** low voltage version of LZM, especially designed for BM technology
 - **Kronos:** A revolutionary coating formulation able to match at the same time the characteristics of the best “low voltage” and “low oxygen” anodes; under field validation

New anode coatings

- Continuous Improvement and extensive field experience from the cooperation between De Nora and tk Nucera, have brought to diversification in two versions:
 - **G02-N:** exactly the same power consumption and selectivity performances of the traditional “low chlorate” JP202N reducing the cost and providing high resilience to NM price variations. It configures itself as the new low chlorate state of art.
 - **G02-R:** with exactly the same power consumption and selectivity of the traditional “low oxygen” JP202R reducing the cost and providing high resilience to NM price variations. It configures itself as the new low oxygen state of art.

New anode coatings positioning - performance



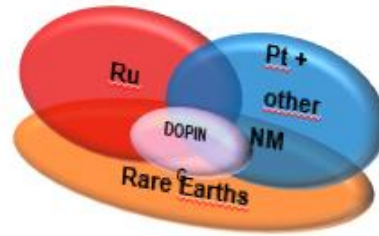
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Cathode coatings

- The new coating generation is characterized by a series of “must have”:
- Low overpotential for hydrogen discharge (HOV)
- Long stability of low HOV during the lifetime
- High robustness against operational mishaps
 - Resistance to reverse currents (long stacks)
- Suitable for the application on the new generations’ fine screen geometries and providing smooth surface to prevent abrasion effect on membrane
 - Older, thick and porous, non-Noble metal coatings (NiOx, Ni Raney, galvanic Ni-alloys) became impractical to use

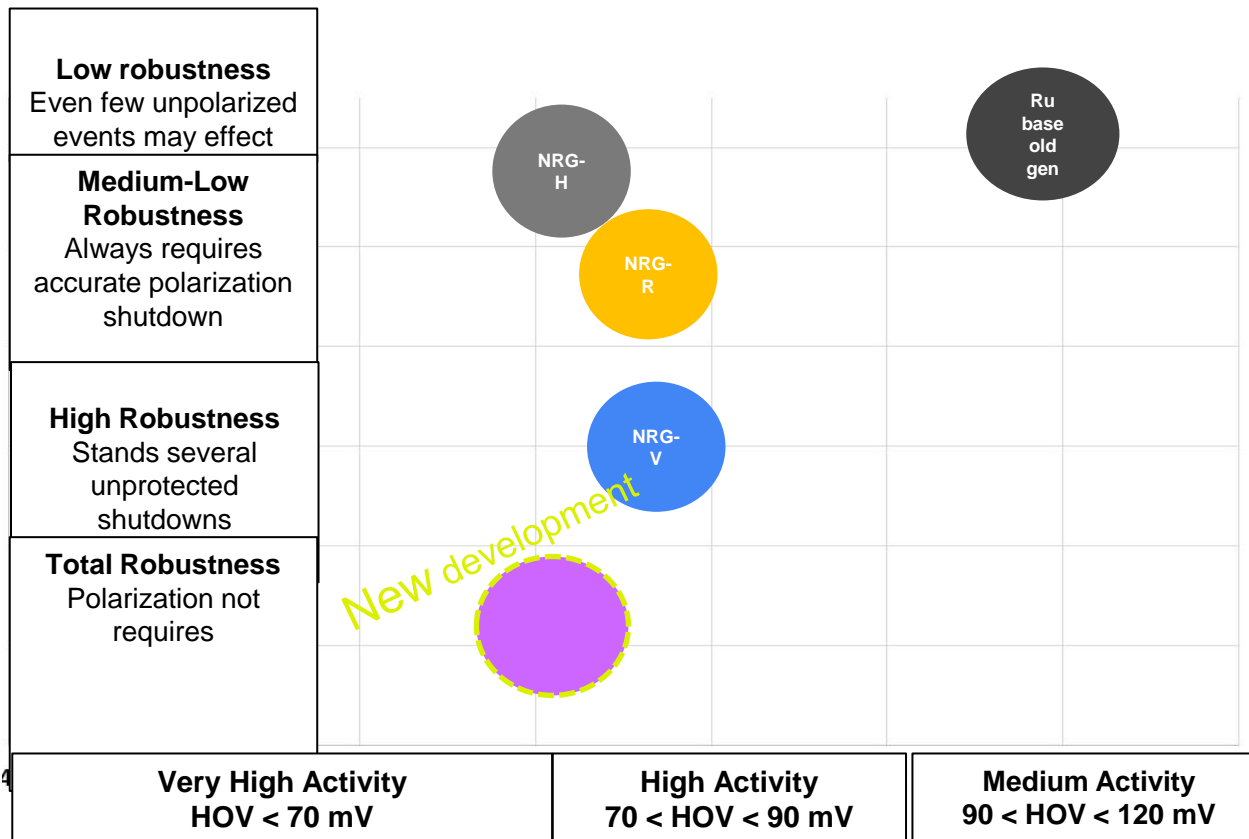
Developments on cathode coatings - NRG® family

- Continuous improvement brings to new formulation in NRG® family to optimally cover different operating situations & scenarios
- Noble Metals are the heart of NRG® family: Ruthenium, Platinum + others to set superior catalytic performance
- Rare Earths are added to impart top robustness
- Doping allows to achieve still more challenging performance
- New innovative precursors seed a unique crystal lattice



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Developments - NRG®family



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Capital Controls® Gas Feed & Emergency Gas Scrubbers

The Most Trusted Name in Chlorine Gas Feed



WATER MADE EASY

MARINE

ENERGY

MUNICIPAL

INDUSTRIAL



Introduction

- 60 years of experience
- ISO-9001 Certified
- Chlorine Institute member
- Regional Offices for technical and application support
- Global partner network for local sales and service



Value Proposition

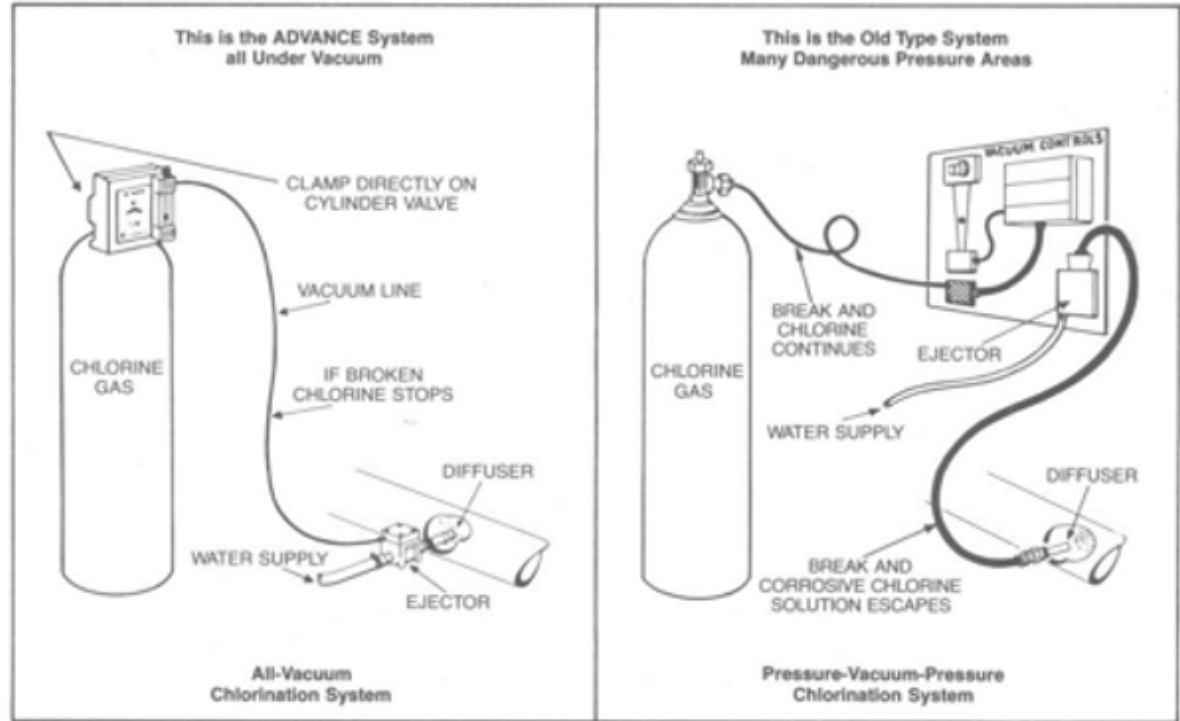
The Capital Controls® Advantage

- ④ Safety first, Capital Controls invented the all-vacuum chlorine feed system in 1960
- ④ Robust design for many years of service
- ④ Superior materials of construction
- ④ Gas feed, emergency gas scrubber and container shut-off packages
- ④ Global sales and technical support, local parts and service



Leading Edge Technology- All Vacuum

- ❶ Direct container mounting the vacuum regulator eliminates dangerous chlorine gas pressure lines
- ❷ Remote mounting the ejector eliminates chlorine solution lines
- ❸ A vacuum line leaks air in, no chlorine gas out, vacuum regulator inlet valve closes on loss of vacuum
- ❹ Superior materials of construction



Gas Feed & Emergency Gas Scrubbers

- ⑩ Vacuum operated-solution feed is the safest method of adding chlorine to any process
- ⑩ Gas chlorine is the most economical method of disinfecting drinking water
- ⑩ Long lasting residual provides primary and secondary disinfection
- ⑩ Low Capex and Opex
- ⑩ Minimize disinfection by-products; no chlorite, chlorate or bromate
- ⑩ A true emergency gas scrubber prevents fugitive chlorine gas leaks to the environment



Vacuum Operated for any Applications

- Low-capacity gas feeders to 500 lb/day (10 KG/h)
- Sonic control valves and wall panels to 3,000 lb/day (60 KG/h)
- Automatic control valves with on board controllers
- Design flexibility for multiple dosing points



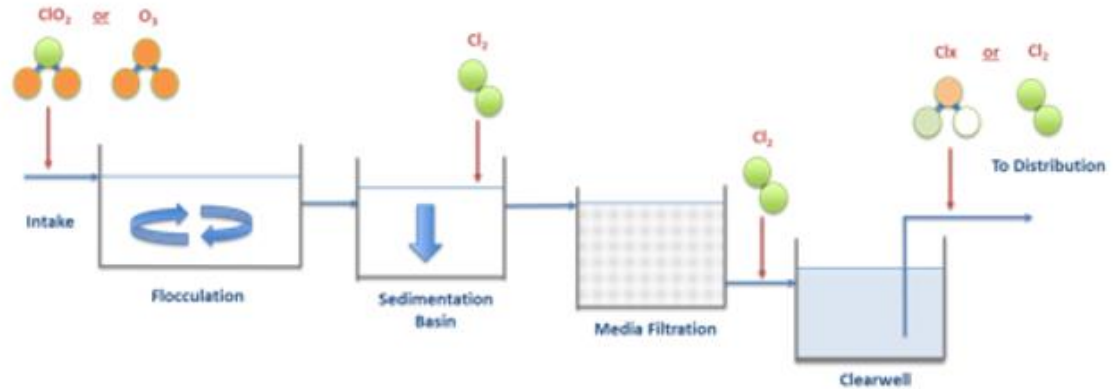
High-Capacity for large Applications

- ❶ Chlorine vaporizers to 12,000 lb/day (227 KG/h)
- ❷ Compact floor cabinet gas feeders to 8,000 lb/day (150 KG/h)
- ❸ Full size floor cabinet gas feeders to 10,000 lb/day (200 KG/h)



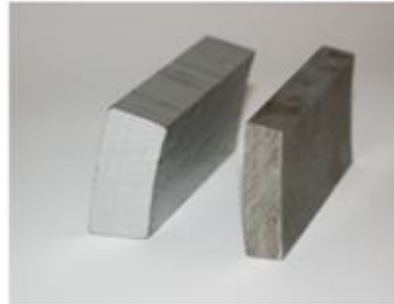
Applications

- ⦿ Potable water primary and secondary disinfection
- ⦿ Primary, secondary and tertiary wastewater disinfection
- ⦿ Oxidation of iron, manganese, H_2S
- ⦿ Cooling water biocide
- ⦿ Food and beverage
- ⦿ Metals fluxing
- ⦿ Cyanide reduction



Differentiators

- ❶ Superior materials of construction
- ❷ Sonic velocity feeders to 3,000 lb/day (60 KG/h)
- ❸ Compact floor cabinets
- ❹ Automatic control valves with on board controllers
- ❺ Vaporizers with the heaviest chamber wall in the industry



Expertise and Support

- ④ Globally recognized leader in water
- ④ Decades of experience in municipal and industrial markets
- ④ Reliable and effective treatment solutions
- ④ Knowledgeable and expert staff
- ④ Global aftermarket solutions
- ④ Local partner support
- ④ Comprehensive range of Disinfection technologies



Safety+Innovation+Support =Best Value

- ❶ Invented the all-vacuum gas feed system in 1960
- ❷ Superior materials of construction
- ❸ Only supplier of wet and dry, true emergency gas scrubbers
- ❹ 60 years of experience, global installed base
- ❺ Regional sales and technical support, global partners for local parts and service





DE NORA
discover more



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