



## Boldrocchi Is Worldwide





- Fans, blowers & compressors
- Coolers & heat exchangers
- Particulate matter removal & flue gas treatment
- Noise protection/silencers
- Heavy-duty process dampers
- Service & retrofits

We offer integrated solutions.



RO

LORO

## Our **Expertise** in O&G

#### **Applications**

- Hydrogen reformers
- Sulfur recovery
- Ethylene cracking furnaces
- Catalyst cracking reduction (CCR units)
- LNG
- Gas treatment units
- Hydrocracking
- Gas sweetening and acid gas removal
- Tri ethylene glycol (TEG) regeneration



### Our **Expertise** in Fans

## Fan innovators & experts **since 1909**.

- 110 years experience
- Installed power  $\leq 10 \text{ MW}$
- Completely customized design
- Manufactured in-house
- Tested in-house
- Largest fan test room capability in Europe



**Designed to conform with:** Shell, ExxonMobil, Saudi Aramco, KBR, Technip, Haldor Topsoe Air Liquide, Air Products and others.

### **Fan Packages:** Critical Elements of the Reformer Process

- Fans
- Blowers
- Silencers
- Air intake systems with eventual filtering systems
- Air preheaters
- Dampers
- Motors & variable speed drive systems
- Steam turbine systems
- Lube oil units



## Importance of Integrated Design

- Splitting supply chain leads to overdesigning:
  - <sup>†</sup> CAPEX
    - Each supplier takes a margin
    - Cost of each piece increases
  - If each supplier adds 10% margin
    - ▲ between actual vs. real operating parameters = too large
- One supplier can find ways to save CAPEX



CAPEX

PERFORMANCE



## Fan Systems in the Reformer Process

- A forced draft fan: combustion air to the burners
- An induced draft fan: extracts exhaust flue gases from reformer chamber







# **Complexity** of Fan Systems Design

Design - API 560 or API 673

- Rotor dynamics analysis
  Limits radial vibration
- Finite element analysis
  Optimizes weight & load
  - Optimizes weight & loa
- Torsional analysis
  - Limits torsional vibration





## Importance of **Identifying Torsional Forces** on Variable Speed Systems

- Measurement requires special devices & many companies don't bother
- We developed software programs internally to perform torsional analysis
  - Use Holzer calculation method
  - System's operation logic verified and set to avoid operation near critical speeds

**Campbell Diagram for Critical Torsional Speed** 



SPEED [RPM]



## **Benefits** of Fan Driver Double-Regulation Systems



Can optimize plant efficiency
 production
 energy

- We've designed more than any other company
- Double-regulation now possible for hydrogen reformers thanks to VFDs

## Advantages of **Double Regulation** using VFDs in Hydrogen Reformers



## **Advantages** of Double-Regulation using Steam Turbines (Ammonia & Methanol Plants)

- Usually 2 drivers for reliability
  - Steam turbine = main driver
  - Electric motor = backup
- 2 clutches used to engage/disengage idle driver
- Double regulation: reducing steam turbine driver speed to reduce consumption





## Benefits of **Customizing** the Driver System



### Importance of **Bearings & Lube Oil** Systems

- Sleeve bearings on fans need fresh oil via lube oil system
  - Ensure reliability
  - Reduced maintenance
- Designed to API 614







## Importance of **Monitoring** the System

- We design customized local instrumentation module
- We supply complete machine monitoring solutions
  - Vibration
  - Temperature
  - Speed
  - Communicates with plant's main control system

## Rosneft Tuapse Refinery, Russia

#### **Hydrogen Reformer Island**

- Forced draft fan, 1300 kW
- Intake system:
  - Flowmeter
  - Silencer
  - Exhaust fumes bypass connection
  - Lube oil unit
- Induced draft fan, 3200 kW
  - Discharge silencer
  - Lube oil unit





## Lukoil, Bourgas, Bulgaria

#### **Hydrogen Reformer**

- Induced draft fan, 700 kW
- Complete machinery train
- Special construction on spring isolators to mounting atop reformer steel structure



## Banggai Ammonia Project, Indonesia

#### Fan Systems for Steam Reforming

- Forced draft fan, burners
  0.53 MW
- Induced draft fan, exhaust fumes 1.1 MW
- Steam turbine system (API 611 @ 4500 rpm)
- Silencer
- Damper
- Bearings





## Engro Fertilizer Plant, Pakistan





#### Methanol Steam Reformer

- Flue gas fan package, 3800 kW
- Double regulation drive
  - Steam turbine with gearbox
  - Electric motor with VFD
- Lube oil system



## Iowa & Louisiana Ammonia Plants, USA



#### Incitec Pivot's New Dyno Nobel Ammonia plant, in Louisiana

- Combustion air and flue gas fan
- Steam turbine driver

#### Iowa Fertilizer Company's new plant in Wever

- Combustion air and flue gas fan
- Steam turbine driver
- Back-up motor

## Fan Systems **Crucial** to Reformer Performance

- Fan systems crucial & complex
- Customized systems ensure reformer quality and reliability
- One supplier for entire system important:
  - Avoids overdesign
  - Ensures all pieces in perfect coordination
  - Reduces CAPEX
  - Improves reformer performance



## Thank you.







#### Our Qualifications

#### **USERS/ LICENSORS**

- ENI
- Shell
- Total
- ExxonMobil
- Chevron
- Dow Chemical
- Aramco
- SABIC
- ADNOC
- ADGAS
- ADCO

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- The set leader to be approximate the set

- GASCO
- Takreer
- NIOEC
  - Petrobras
- PDVSA
- ♦ EIL
- PDIL
- Enel
- SEC
- KBR
- Haldor Topsoe

B



