

Reciprocating Compressors

Product overview

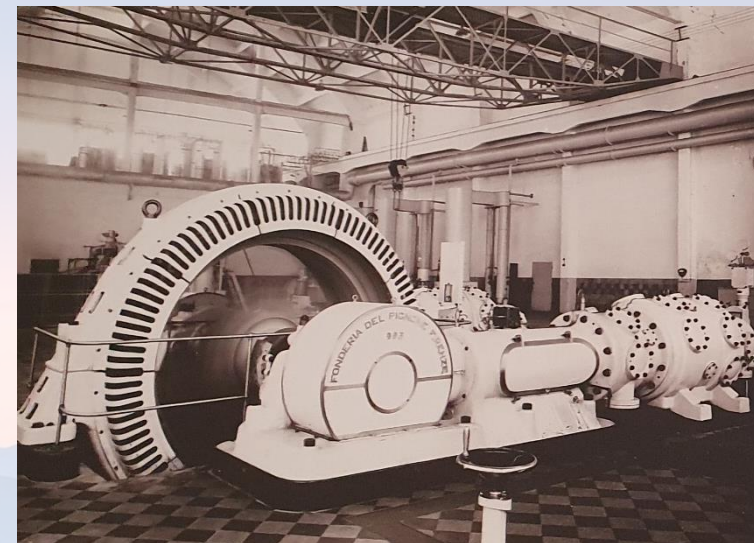
150+ years of experience in hydrogen!



*First combustion engine,
running with H₂, **1854***

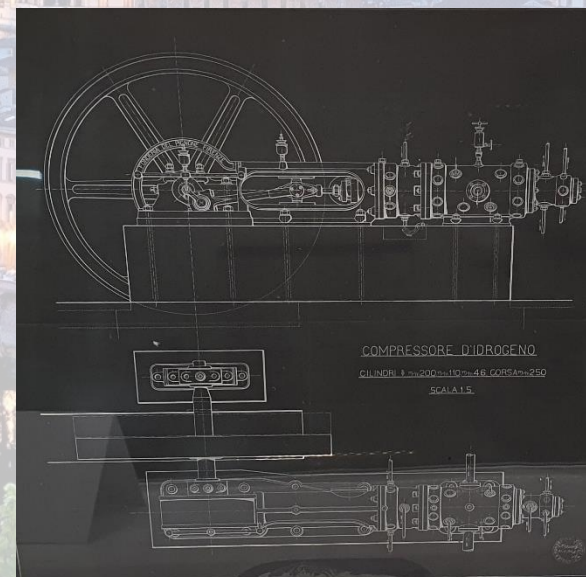


*Ammonia compressor **1910***



*Ammonia compressor at
860 bar, **1930***

*Hydrogen compressor **1915***



More than 100 years of experience

- 1910 First **ammonia** synthesis compressor
- 1910 First **hydrogen** compressor
- 1930 Reached **860 bar** ammonia compressor
- 1964 First **hypercompressor** for LDPE
- 1966 First compressors for **re-injection** of associated gas
- 1976 Reached **3500 bar** in hypercompressor for LDPE production
- 1990 Fully balanced compressor for **offshore** applications
- 2014 Installed **38 MW** hypercompressor unit for LDPE production
- 2019 Installed **20 MW** 8-Cylinder API618 unit for clean fuel refinery
- 2020 **200 tons** single lift package
- 2023 #4 Large 8-Cylinder API618 units for **green hydrogen** production



More than 2500 installed units

Serving multiple markets

Refinery

- Hydrocracking
- Hydrotreating
- Hydrodesulphurization
- Reforming
- Other hydrogen services

Chem/petrochemical

- Refrigeration
- Ethylene, HDPE, LLDPE
- Ethylene oxide
- Polypropylene
- Low-density polyethylene

Natural gas

- Re-injection
- Gas lift
- Gathering
- Pipeline
- Storage

Hydrogen

- Production
- Storage
- Tube trailer filling
- Hydrogen Refueling stations

Product line at a glance

API618 slow speed

Process-gas compressors

- Balanced opposed type
- Horizontal and opposed cylinders
- Cylinders: 1 to 10
- Speed (rpm): 300 to 750
- Piston speed (m/s): 3 to 4.5

API618 high speed

Natural gas compressors

- Balanced opposed type
- Speed (rpm): 750 to 1,200
- Piston speed (m/s): 5 to 6
- Common in offshore and FPSO with reduced footprint vs. equivalent slow-speed unit

Hypercompressors

High-power machines for LDPE production up to 3,500 bar

- Unique frame design
- Suction pressure: 200 to 300 bar
- Discharge Pressure: 1,200 to 3,500 bar
- Installed power up to 40 MW

Hydrogen

Large capacity and high pressure, dry service

- Vertical frames 3-6 tons/day up to 550 bar discharge
- Horizontal frames 3-12 tons/day up to 350bar discharge
- Large capacity, up to 150 bar for H2 transportation

Reciprocating Compressor Portfolio

(*) At max. speed and max. number of cylinders

(**) Number of cylinders. Up to 12 cylinders in a single frame

Family	Frame size	Throws	Max. Power (*)	Max Rod Load	Max. Speed
	Model	(#)	(kW)	(kN)	(rpm)
API 618 Process	OA	1	435	117	800
API 618 Process	HA	2-4	2,120	145	1,000
API 618 Process	HB	2-6	5,520	236	800
API 618 Process	HD	2-8	10,400	322	700
API 618 Process	HE	2-10	28,700	607	800
API 618 Process	HF	2-10	34,600	1,140	514
API 618 Process	HG	2-10	66,820	1,980	514
API 618 Natural Gas	SHM	2-6	7,980	358	1,200
API 618 Natural Gas	SHMB	2-4	5,320	358	1,200
LDPE	PH	4-24 (**)	36,000	1,450	310
LDPE	PK	4-24 (**)	72,000	2,900	310
Hydrogen Refueling	HRS550	2-4	560	236	388
Hydrogen Storage	HB Hyrcel	2-6	5,520	236	388
Hydrogen Storage	HD Hyrcel	2-6	10,400	322	322
Hydrogen Storage	HE Hyrcel	2-6	28,700	607	270

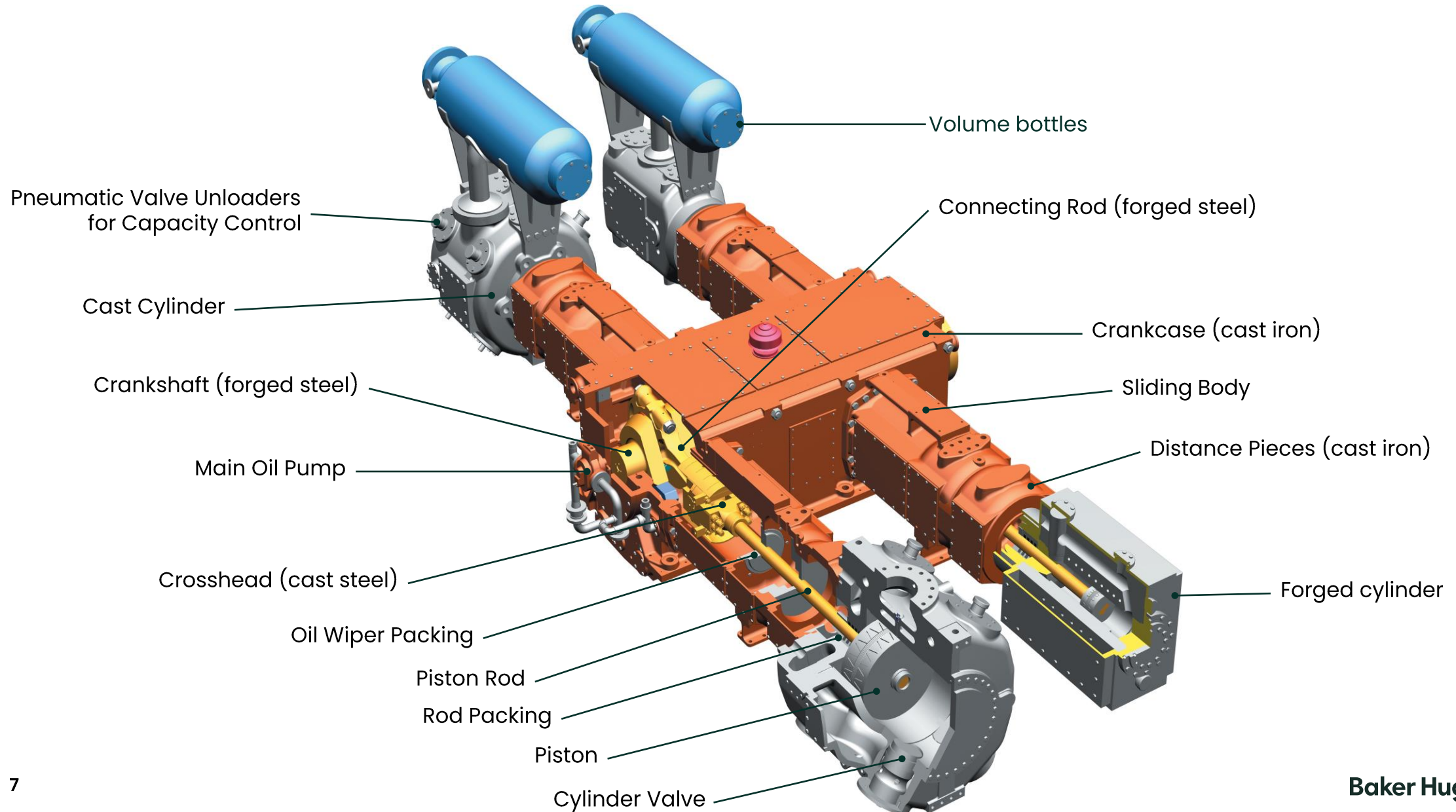
100+ years of experience serving multiple markets ... from Refinery and Petrochemical to Natural Gas and Hydrogen for Energy Transition

Baker Hughes Confidential

API618 Process Gas Compressors

Product Line Overview

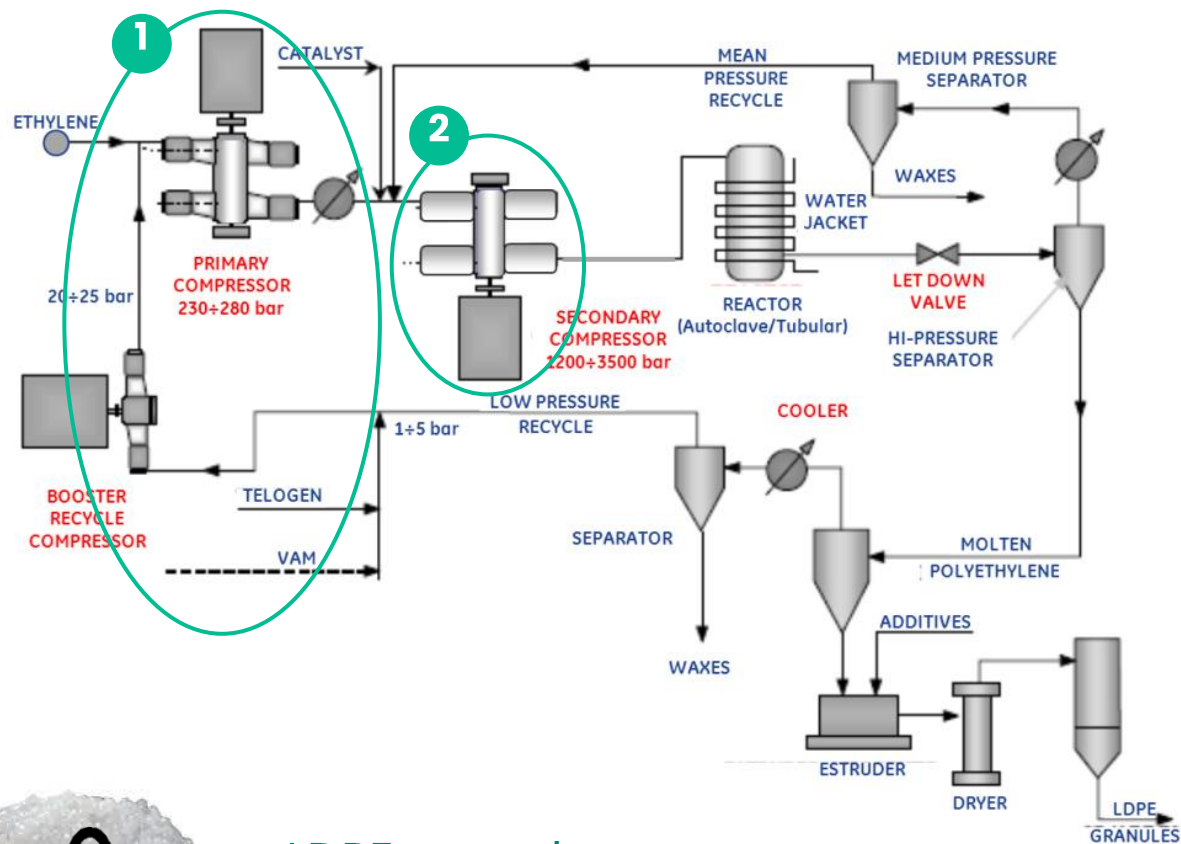
API618 reciprocating compressor main components



LDPE Compressors Product Line Overview

Low Density Polyethylene (LDPE)

A challenging Reciprocating Compressor application



LDPE granules
used to produce films, food
plastics, solar panel coatings



1 Booster / Primary Compressor

- Two services on single frame
- 2-3 stages on Booster and 2-3 stages on Primary
 - 6 or 8 cyl's configuration
 - Suction Pressure: 1-2 bar
 - Discharge Pressure: 300 bar
 - Installed power up to 10-12 MW
 - Scope of supply includes process gas plant... vessels, separators, gas coolers & control/safety valves

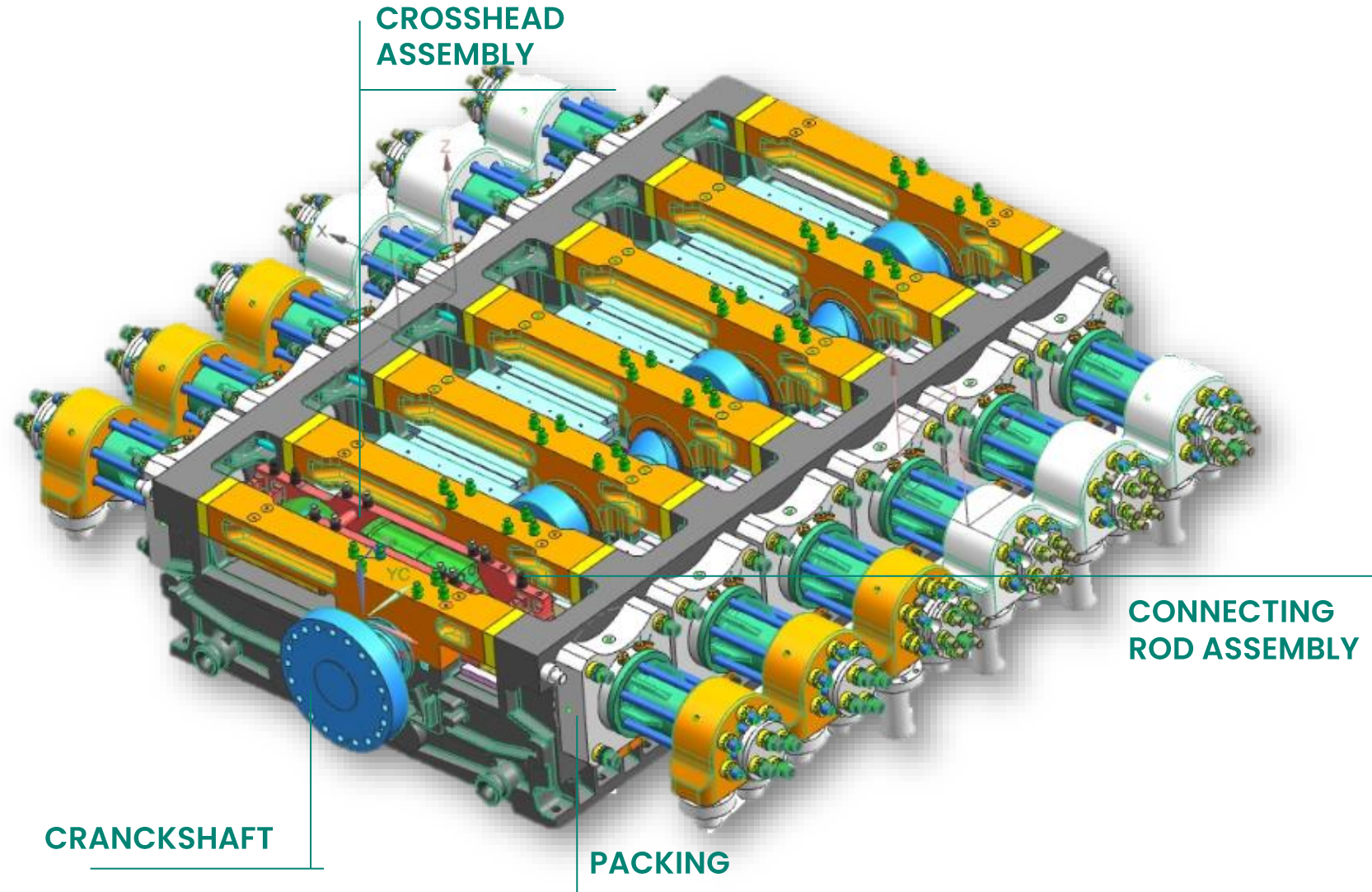


2 Hyper-Compressor

- 2 stages service
- Suction Pressure: 200-300 bar
- Discharge Pressure: 1200-3500 bar
- Installed power up to 40 MW
- Bigger installed hyper is a 20PK, 20 cylinder's twin frame with 33 MW installed power

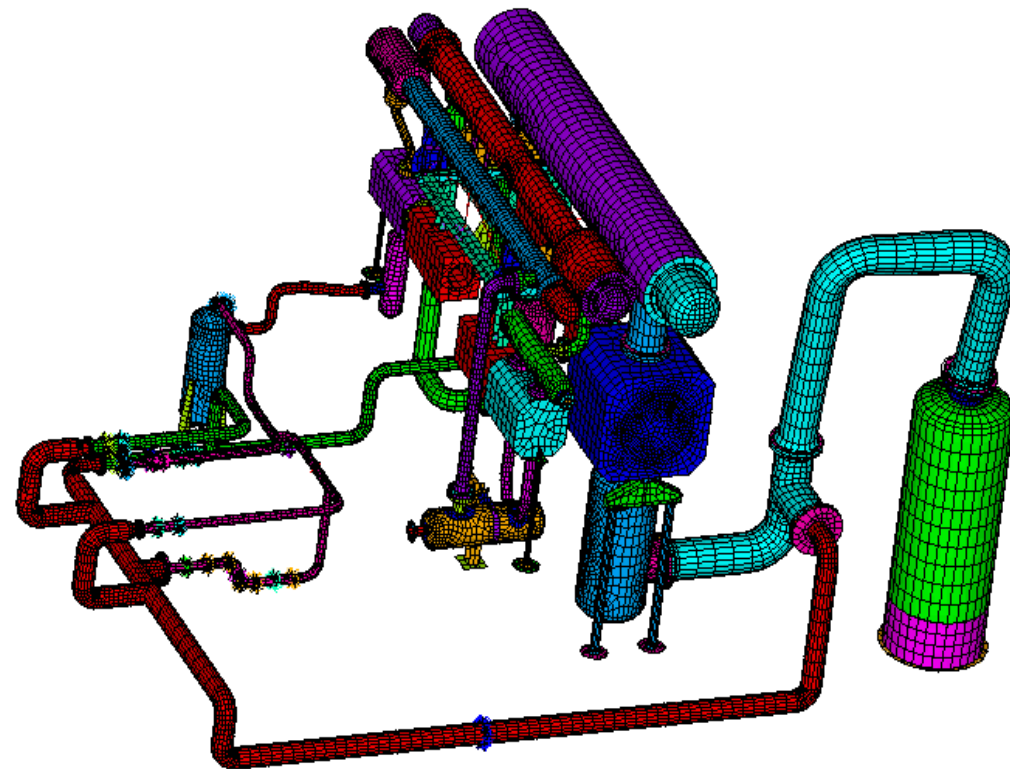
Hypercompressor

Main Components



Acoustic and Dynamic Piping Analysis

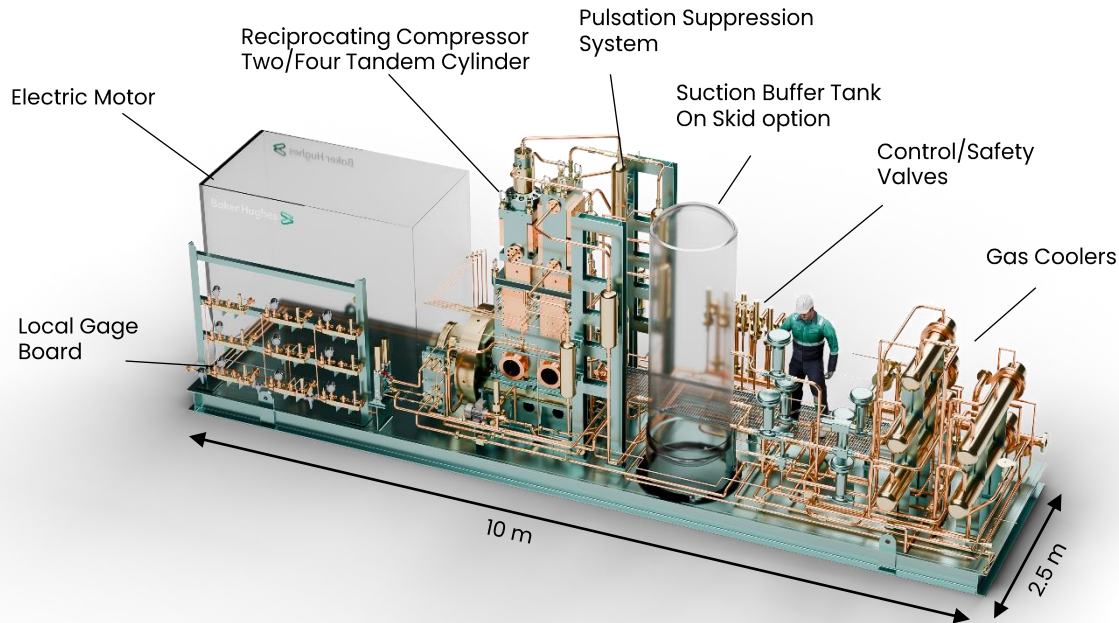
- Baker Hughes – Nuovo Pignone started **Acoustic Analysis** in the mid-sixties with an analogue **simulator**
- Unique in-house team expertise
- Extensive experience, **more than 1,000 plants analyzed**
- Always performed in conjunction **with mechanical analysis**
- Proprietary digital program in use **since 1989**, tuned with our analog **simulator** and **field test**
-- validated with **over 25 years of experience**



Expertise, modern tools and facilities to define the optimum configuration for any type of Reciprocating Compressor plant until the most critical as LDPE plants

Hydrogen Solution No-Lube High Pressure Compression

HRS550 (Hydrogen Refueling Station Compressor)



Compact and modular compression solution for Hydrogen Refueling Station and Tube Trailer Filling
Reliable, compact, modular

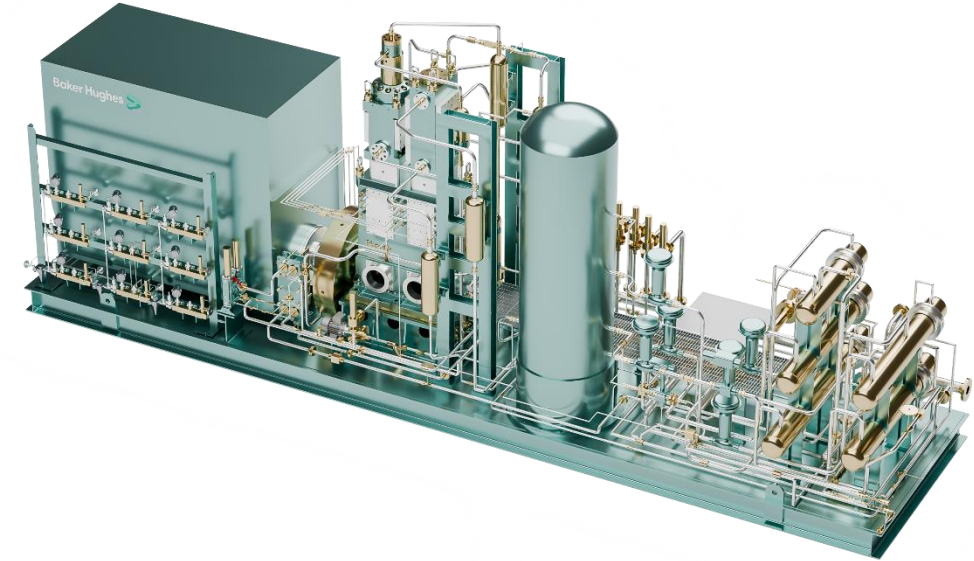
Product name:	HRS550
Arrangement:	Vertical
Gas composition:	H ₂ (purity>99.9%)
Cylinder lubrication:	DRY service (NO LUBE)
Suction Pressure:	from 30 bar
Discharge Pressure:	up to 550 bar
Mass Flow:	3 or 6 tpd
Skid or foundation:	skid



HRS standard scope of supply

On Skid:

- Compressor
- Driver
- Pulsation Suppression
- Frame Lube oil system
- Cooling water system
- Interstage water coolers
- **Option** for Buffer Tank



Battery limits

- H2 vent line
- Water in and out
- Electric Power
- Instrument Air
- N2 buffering
- Process connections

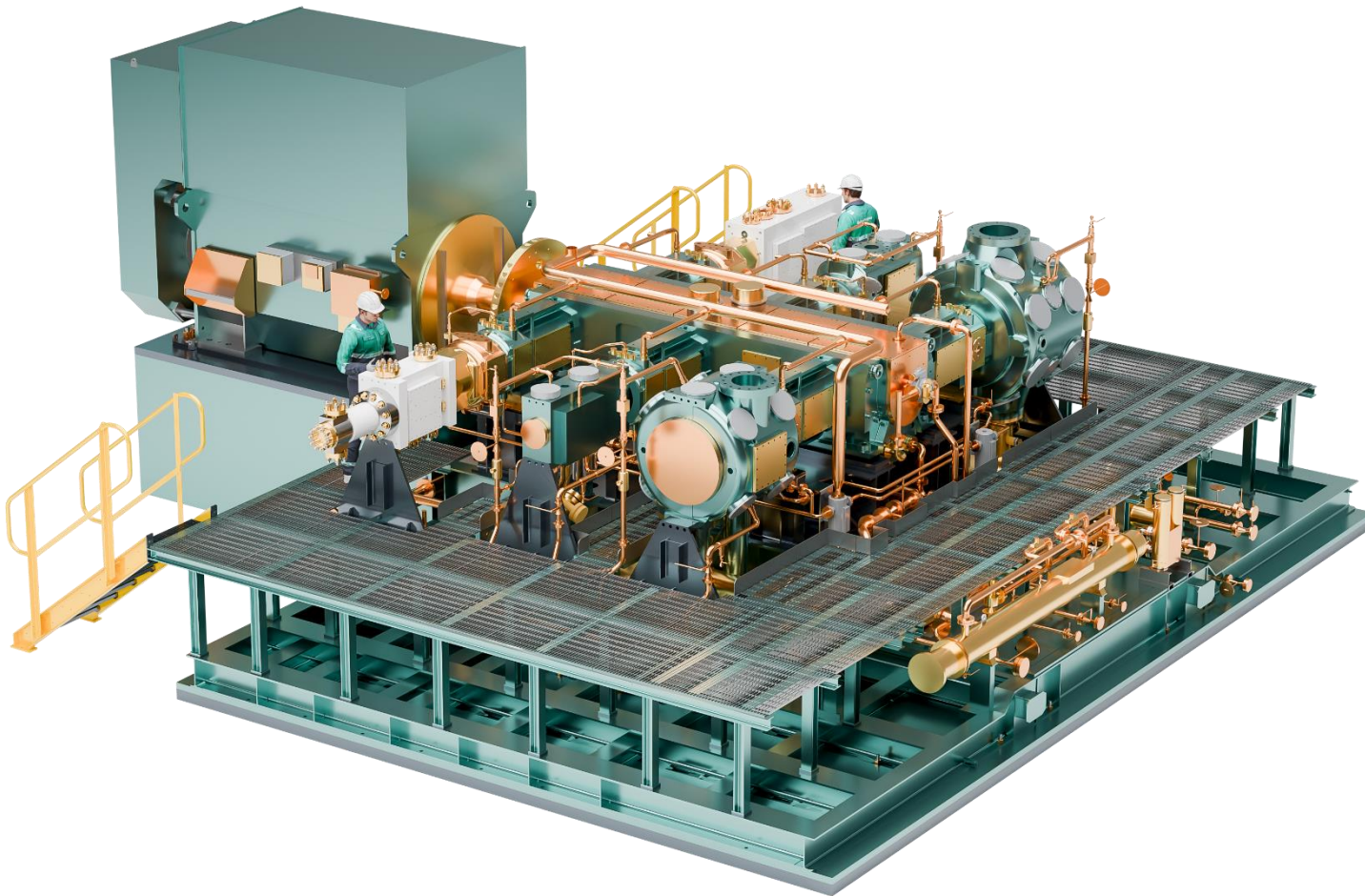
Standard Control Panel

- Start/Stop and Protection
- Capacity Control
- Auxiliary Management

Option:

- *Remote Maintenance*
- *Diagnostic Services*
- *Unmanned solution*

Hyrcel (Hydrogen Reciprocating Compressors for Electrolyzers)

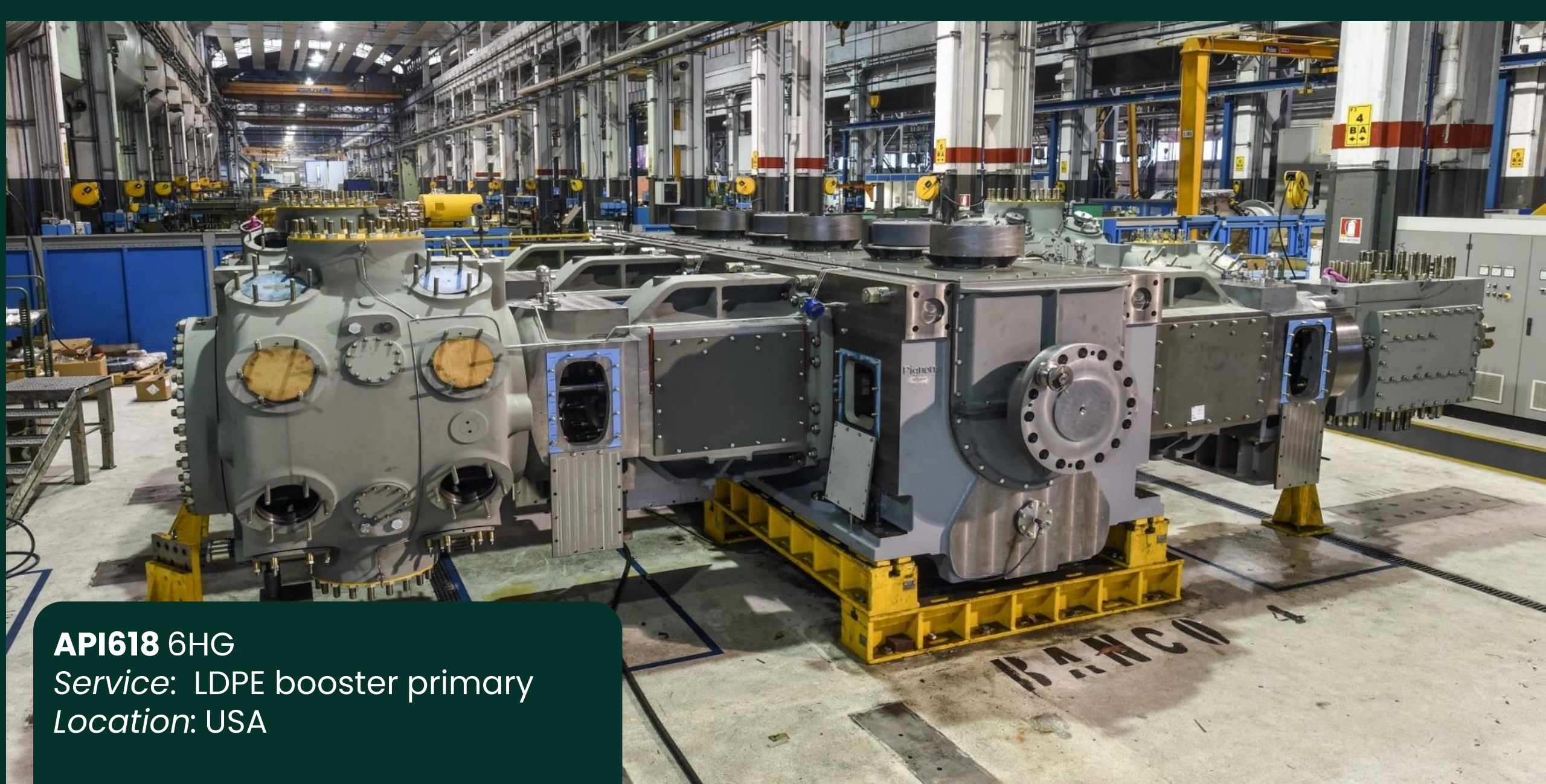


HB frame: from 3 to 5 tons per day, 350 bar
HD frame: from 5 to 8 tons per day, 350 bar
HE frame: from 7 to 12 tons per day, 350 bar

Product name:	Hyrcel
Arrangement:	Horizontal
Gas composition:	H ₂ (purity>99.9%)
Cylinder lubrication:	DRY service (NO LUBE)
Suction Pressure:	from 1 to 30 bar (depending on Electrolyzer technology)
Discharge Pressure:	up to 350 bar
Suction Temperature:	up to 40°C
Mass Flow:	from 3 to 12 ton/day
Skid or foundation	Both (depending on size of the machine)
Absorbed Power:	From 425 kW to 2.5 MW depending on size and duty

Hydrogen compression for wide range of flow and duty, ranging from compact skid solution to large capacity.
Proven, reliable, compact.

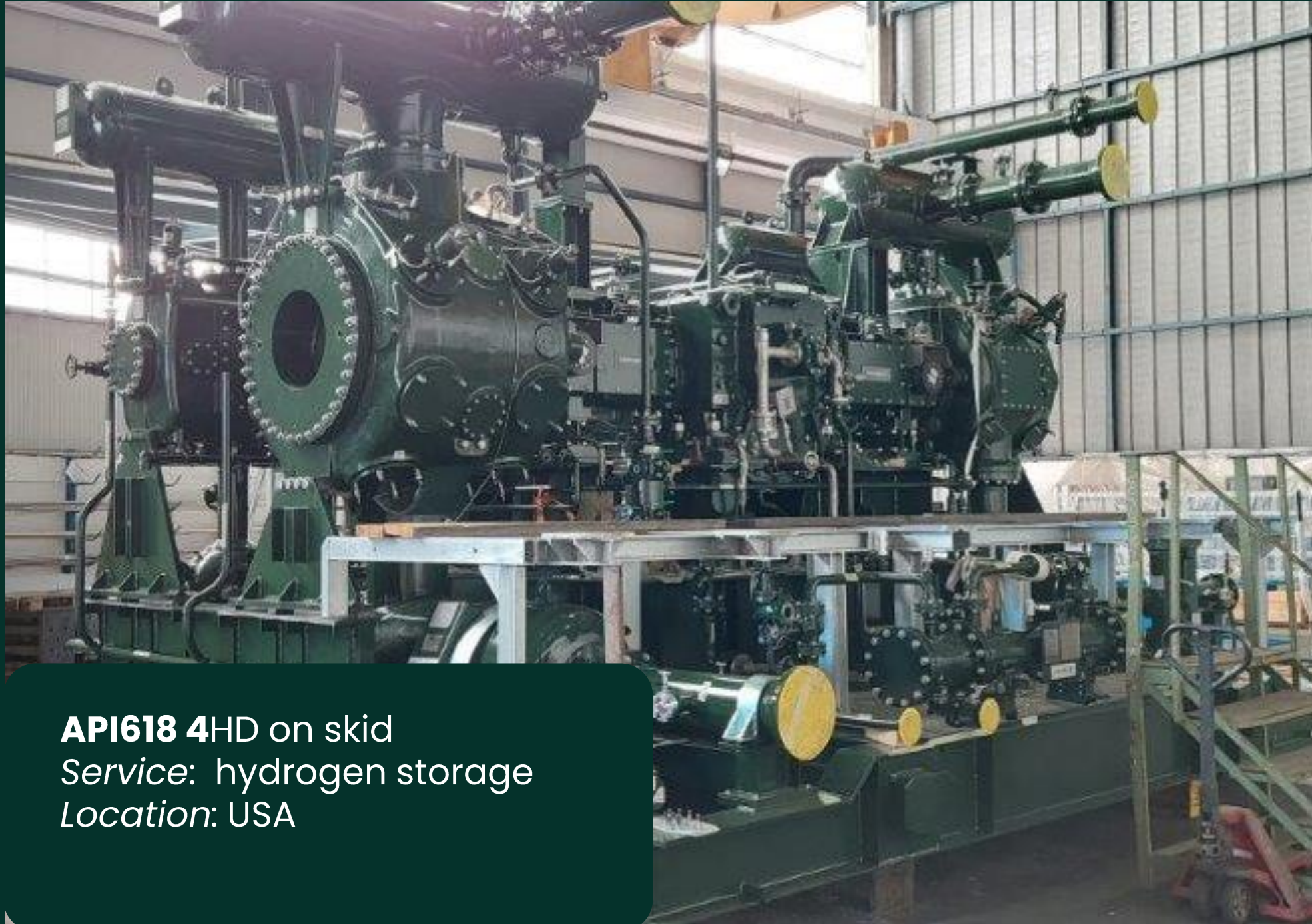
Pictures



API618 6HG

Service: LDPE booster primary

Location: USA



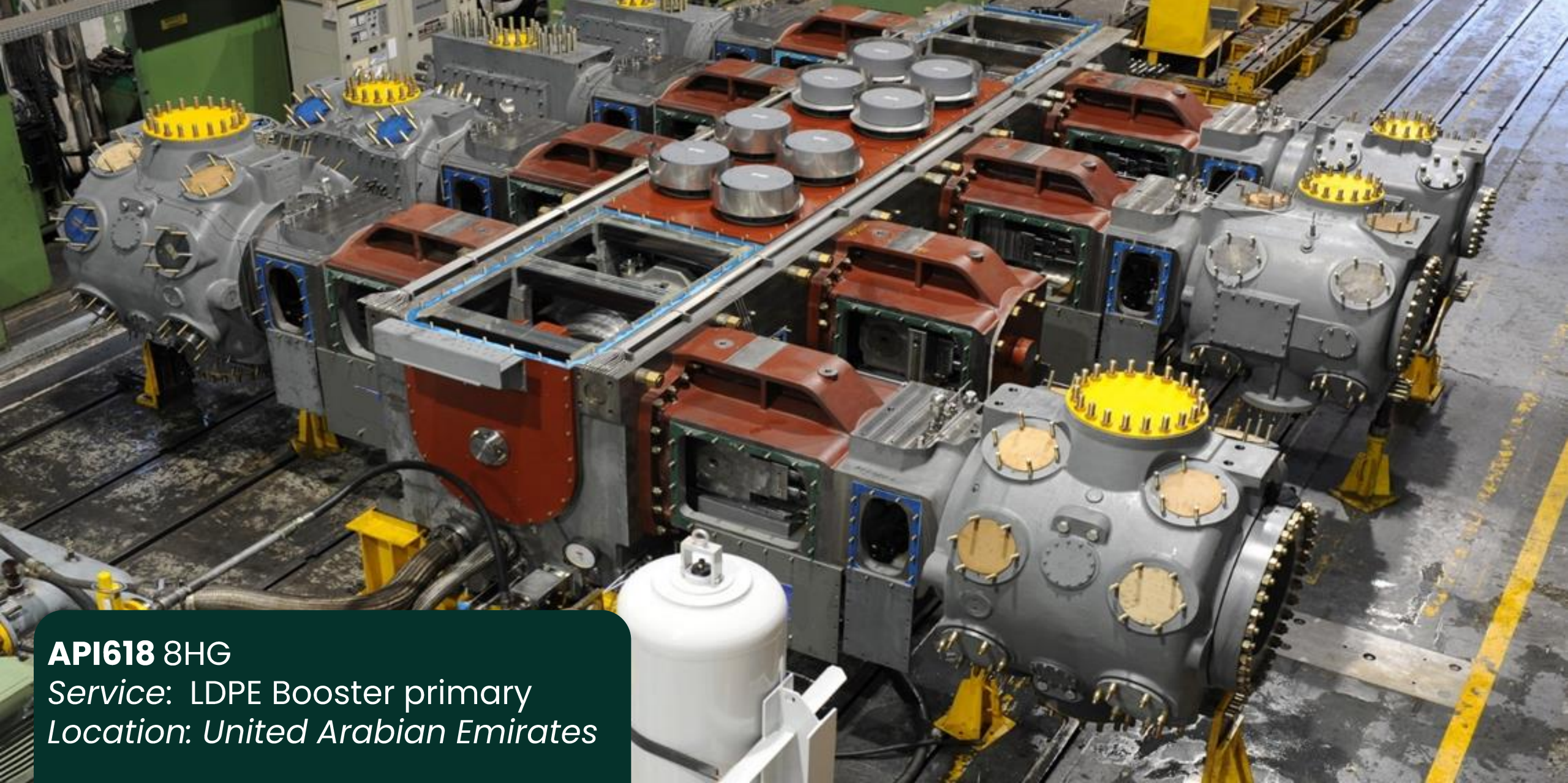
API618 4HD on skid
Service: hydrogen storage
Location: USA

A large, white, cylindrical industrial hydrogen storage vessel, API618 8HG, is shown in a factory setting. The vessel has multiple large circular openings and is supported by yellow stands. In the foreground, a smaller, similar component is visible. The background shows a blurred industrial environment with various equipment and structures.

API618 8HG

Service: Hydrogen storage


Location: Saudi Arabia



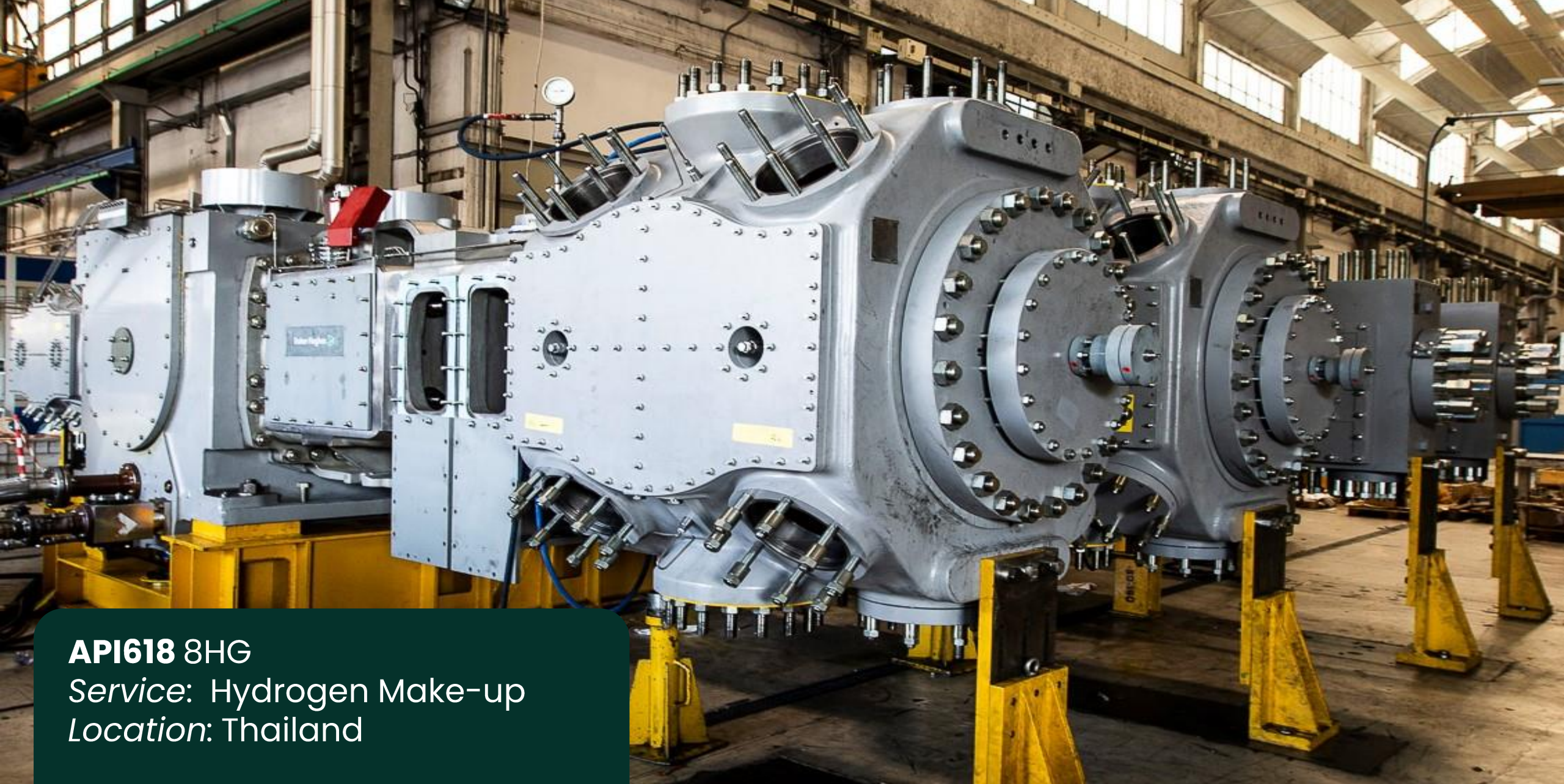
API618 8HG

Service: LDPE Booster primary

Location: United Arabian Emirates



API618 6HE + LDPE 8PK
Service: LDPE Plant
Location: China



API618 8HG

Service: Hydrogen Make-up

Location: Thailand

A large industrial machine, the API618 4HG module, is shown in a factory setting. The machine is primarily green with blue and red structural elements. It features a complex network of pipes, valves, and a large horizontal cylindrical tank at the top. The machine is mounted on a white base and surrounded by blue metal walkways with railings. The background shows a typical industrial environment with various equipment and structural elements.

API618 4HG module
Service: Hydrogen Make-up
Location: UK



API618 8HG

Service: Hydrogen Make-up

Location: Kuwait

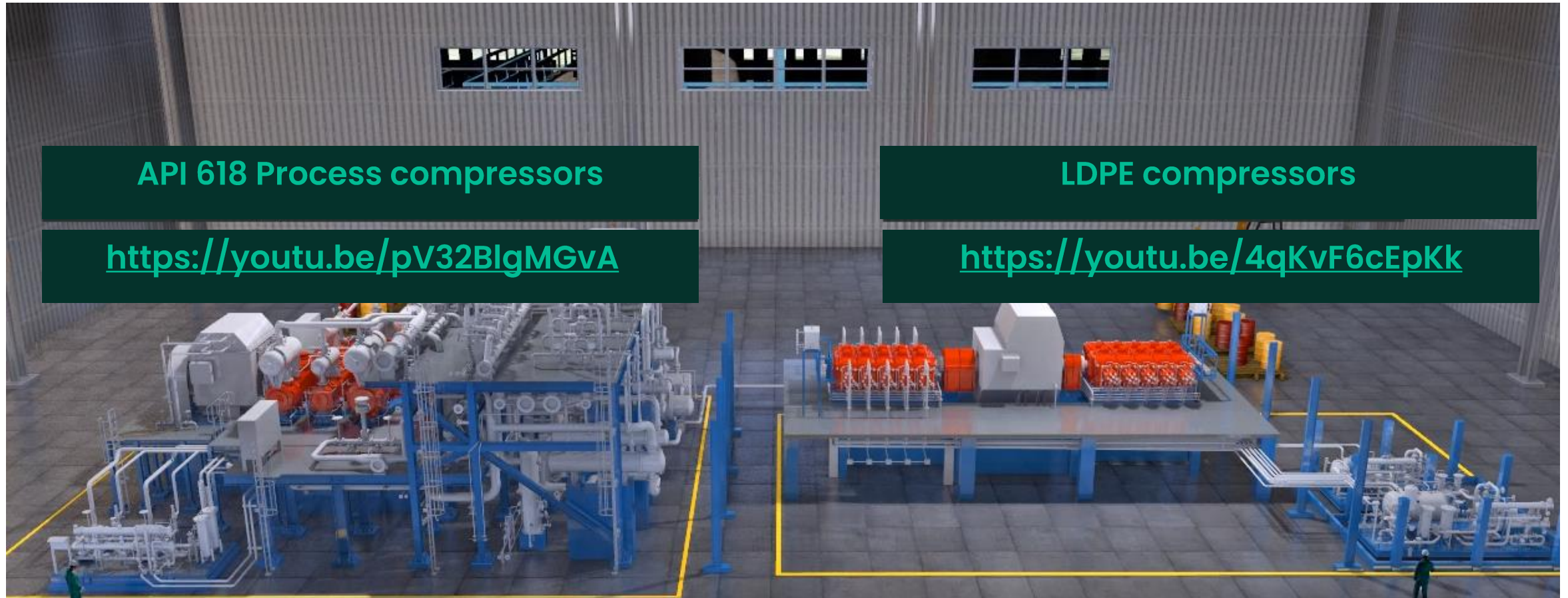


LDPE 12PK

Service: LDPE plant

Location: Canada

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