Refrigeration solutions

Oil & Gas applications

C. GUASTAROBA, CASTEL MAGGIORE, SEPT 2016
Refrigeration in Oil & Gas industry
Upstream, midstream and downstream

**Upstream**
- **Oil & Gas Exploration/Production**
  - Offshore Oil & Gas platform
  - Onshore Pump jack

**Midstream**
- **Transport & Storage**
  - Process & Storage
  - Transport

**Downstream**
- **Product, Preparation & Usage**
  - Refining & Purifying

**Pipeline**
- Oil & Gas transfer
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Refrigeration Solutions
Flexible supply options

Process design:
HYSYS Process simulation, Detailed Engineering Design, 3D modeling, Full thermal design & rating, HE HTRI design, documentation and Drawings.

Complete skid mounted packages, fabricated in Italy, US, China and Russia with major component supply, for integration into a larger system

Site supervision, commissioning and start up

Consulting services
Feasibility Study, expert advice on improving your plant processes, capacity upgrades and more.

Revamping and Retrofitting

Offshore design
three points support, vibration & pulsation study, weight & space reduction design

HAZOP, SILO, FMECA & RAM Analysis

Training
Cooling capacity range

**Mini**
- from 250 up to 800 kW
- Customer: Fincantieri
  - Country: Italy
  - Capacity: 600kW

**Small**
- from 800 up to 2000 kW
- Customer: Jacobs
  - Country: Saudi Arabia
  - Capacity: 876kW

**Medium**
- from 2000 up to 6000 kW
- Customer: Marathon Oil
  - Country: UK, North see
  - Capacity: 2.995 kW

**Large**
- from 6000 up to 40.000 kW
- Customer: Linde Engineering
  - Country: USA
  - Capacity: 6.462 kW
Technology

Compressor Technology selection:

- Screw oil injected / dry
- Reciprocating
- Centrifugal

as function of application feature via different indicators, e.g.:

- Pressure ratio
- Discharge temperature
- Process fluid composition

Complete set of Refrigerants/Process fluids:

- Freon/Hydrofluorocarbons
- Ammonia
- Hydrocarbons
- CO₂
- Mixed refrigerant

Process Cooling / Boil Off Gas / Chiller / Cascade system with cooling capacity from 250 kW un to 40 MW
Environmental constraints

Hazardous area installations

Zone 1 / 2

Site ambient conditions

High temperature (Middle east)

Low temperature (Russia)

High ΔT during the day/year

Marine / corrosive

Offshore
Customized execution

**Studies and Analysis**
- Process simulation
- HAZOP
- Safety integrity levels
- RAM
- FMECA Analysis

**Customers’ design & engineering practice**
- Shell DEP
- PETRONAS (PTS)
- SAUDI ARAMCO (SAAMS)
- Other

**Countries certificates**
- PED
- SASO
- TR CU
- Any international local certification

**Design codes**
- API
- ASME
- TEMA
- GOST
- Other
**Scope of supply - Refrigeration package**

Compressor No.1x100 %, No.2x100%, No.2x50%, No.3x50%
Depending on process loads requirements & reliability plant client’s requirements

Compressor lube oil system
Separation, cooling, distribution

Air / Water condenser

Process evaporators / chillers

Economizers

Liquid Receiver / Refrigerant accumulator

Various accessories:
- Local / remote control panel
- Machine monitoring system
- Gear boxes to increase / decrease the speed velocity
- Soft starters / inverters
- Noise hood & noise level control system
Scope of supply - not only refrigeration package…

- Fully integrated mechanical and electrical solution: high integrity control systems, motor control center
- Flare header & PSV skid
- Filtering system
- Separation system
- Pressure reduction system
- Heating system
- Interconnecting piping / Structures / Support / Pipe Rack and others auxiliaries
- Firefighting system
- Winterization
- Insulation (cold / hot / personal protection)
Scope of supply: Test

FAT
- Performance Test
- String Test for Oil Injected screw compressor
- High pressure Pneumatic Test
- (Deep) Vacuum test
- Visual & Dimensional Test

NDT (Non Destructive Tests):
- Liquid Penetrant Test
- Radiographic Test
- Magnetic Test
- Ultrasonic particle Test

Hydrostatic test(personale interno)
- Leak Test 0,5 bar
- Positive material indicator
Oil & Gas Clients
Our main clients (EPC Contractors and End Users)
Refrigeration reference
Refrigeration global reference map

Compressor type
- Screw
- Reciprocating
- Centrifugal

Refrigerants
- Ammonia
- Hydrocarbons
- Freon
- Mixed fluids

Types and counts:
- Screw: 368
- Reciprocating: 159
- Centrifugal: 15
- Ammonia: 88
- Hydrocarbons: 95
- Freon: 159
- Mixed fluids: 59
Refrigeration global reference map
Customer: Agip Gas BV

Location: Mellitah – Libya

Scope: EP by GEA

Aim: condense/cool down four propane/butane streams coming from storage tanks and LPG splitter trains. Boil off system (open cycle)

Duty: 6130 kW

Production rate: propane/butane storage tanks - 55 tons/h of propane at -45°C and 58 tons/h of butane at -16°C.
Gas Treatment and LPG Production Plant

Customer: STEG
Location: Gabès – Tunisia
Scope: EPCC by GEA
Aim: Turnkey basis

Process units: Gas & Condensate slug catchers, Drying sections (molecular sieves), Distillation Sections with relevant accessories


Plan Design Parameters:
Raw Gas Flow = 51000 Nm³/h
Raw HC Liquid Flow = 25 m³/h
Treated Gas = 40000 Nm³/h
Propane Production (Purity 98%) = 8,5 Ton/h
Butane Production (Purity 97%) = 5,9 Ton/h
Gasoline Production (Purity 99.5%) = 4,2 Ton/h
LPG recovery from natural gas by turboexpander cryogenic process

Customer: Turkmengas (Turkmenistan)

Location: Gaz Aciak - Naip Field

Aim: to recover maximum quantity of LPG and heaviers present in natural gas

Gas cooling in two steps:
first at -40°C/35 bar
second at -85°C/10,5 bar

Main characteristics of the plant:
- High percentage of LPG recovery from natural gas thanks to the low temperatures reached in the process;
- High plant efficiency due to the adiabatic process of gas expanding in the turbine side of the package.
**Ammonia Refrigeration and Boil-Off Unit**

**Customer:** Linde AG Division Engineering  

**End User:** SIMPLOT  

**Location:** Rock Springs (WY)  

**Plant:** Ammonia open refrigeration system;  

**Aim:** Cooling duty at n.2 temperature levels (+30°C and -37°C) for different process applications in an ammonia production plant;  

**Processed ammonia:** around 70 t/h  

**Inlet** to the refrigeration plant: ammonia vapor from ammonia storage & process lp/mp/hp separators.  

**Outlet** from the refrigeration plant: ammonia product/ammonia liquid to consumers.
Refrigeration in Natural gas processing

Customer: Marathon Oil, UK

Location: North Sea

Aim: Dehydrate & Gas Dew Point to export and to gas lift;

Duty: 2.995 kW

Specials:
- Installation on an existing platform → weight & space constrains;
- Anti vibration system → 3 points support;
- Refrigerant R410a with GWP < 2.500

Brae Alpha Operational Information:
Is a regional hub, located in the North Sea, UK sector, for Oil & Gas production. Brae Alpha offers two 3-stage separation trains capable of processing 120,000 bpd of oil and NGLs with a third separation train capable of processing 55,000 bpd of liquids. The NGL recovery plant is capable of handling 17,000 bpd, and an average of 74 mmstd gas processing.
Contact information
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<td>Oil &amp; Gas Refrigeration</td>
<td>Cristiana Guastaroba</td>
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<td>Proposal Manager</td>
<td>Business Area Solution,</td>
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Gas compression solution