TANK BUILDING METHODOLOGY
• **Introduction of Cylingas**

• **Tank Design & Construction Codes**

• **Tank Erecting Methods & Procedures**
  - Conventional Method | Jacking up Method
  - Jacking up Techniques

• **Demonstration – Tank Construction**

• **Cylingas Preferred Method - Jacking**
**INTRODUCTION - History**

- Established in 1974
- Late H.H. Sheikh Rashid Bin Saeed Al Maktoum, the Ruler of Dubai
- Cylingas Started Production in 1976
- First LPG Cylinder Manufacturing Company in GCC.
- Location: Al Quoz Industrial Area 3, Dubai – UAE
INTRODUCTION - *Key Business*

**SITE CONSTRUCTION/EPC PROJECTS**

**SHOP FABRICATION PROJECTS**

**LPG PROJECTS**

**EHS & QUALITY**

- OHSAS 18001:2007
- ISO 14001:2004
- ISO 9001:2008

**MANUFACTURING STANDARD**

- “U”
- “U2”
- “R”
- “NB”
INTRODUCTION - Major Activities

• **EPC / Site Construction Projects**
  – Tank Farm, Plant Piping, Storage Tanks for Crude Oil & Finished Products etc.

• **Pressure Vessels & Tanks Manufacturing**
  – Knock out Drums, Filters, Vent Drums, Separators etc.

• **Gas Projects**
  – Storage Tanks & System Installation for LP, Propane
  – Aerosol/Odorless & Synthetic Natural Gases
  – Piping Networks Industrial, Building etc.

• **Maintenance Projects**
  – Storage Tank Repair, Tank Bottom Plates Replacement, Loading Arm Maintenance etc.
TANKS & PIPING PROJECTS - Executed By Cylingas
EPC Contract
EPC Contract

Design, Engineering, Procurement, Construction, Fabrication & Commissioning of Base Oil Storage Tanks and Vessel, additive vessels, compartmental tanks, 9 Nos. Vertical Storage Tanks (various sizes), 16 Nos. Vessels (various capacities), 6nos. Additive vessels with 7 Vertical Storage tanks, ranging from 5Mts Dia. X 14Mts High to 15Mts. Dia. X 18Mts High 14 Homogeneous vessels ranging from 2.7Mts Dia. X 7.5Mts High. to 4250Mts Dia. X 9Mts High, total plant and utility piping, structural works for pipe racks and walk ways, equipment erection and fire fighting system, loading Bay with associated facilities at inside Port of Fujairah.
Engineering, procurement, construction, & civil works of 7nos. Vertical Storage tanks (3 tanks CS Roof and remaining with Aluminum dome roof). Ranging from 14Mts Dia. X 13Mts High to 40Mts Dia. X 25Mts High.
Design, Engineering, Supply, Fabrication, Painting, Erection/Installation, Testing and Pre-commissioning of 8 Nos. Product Storage Tanks of sizes: 55m Dia x 25m Ht. 4 Nos. & 39m Dia x 25m Ht. and its associated civil works.
DEWA Project - Phase II & Phase III

Engineering, Supply, Fabrication, Painting, Erection/Installation, Testing and Commissioning of 3 Nos. Fixed Cone Roof Diesel Storage Tanks of sizes: 35M Dia x 14.5 M Ht. & 3 Nos. 35Mtrs. Dia.X 5.1Mtrs. high for Diesel & 1 No. 21 Mtrs. Dia.X 15.7 Mtrs. high for Demineralised Water Tank

FUEL FARM - Airports

Design, Engineering, Supply, Fabrication, Painting, Erection/Installation of

**DUBAI Airport:** 5 Nos. Truss Supported Fixed Cone Roof Storage Tank for Aviation Jet Fuel & 1 No. Refuel Storage Tank. Sizes: 33M Ø x 14.6M Ht. (4 Nos.), 17Mtrs. Ø x 11.6Mtrs. Ht. (1 No.) & 7Mtrs. Ø x 5.2Mtrs. Ht. including Floating Suctions

**FUJAIRAH Airport:** 1 No. Aviation Jet Fuel Tank API-650 Size 10Mtrs. Ø x 10Mtrs. Ht.
Erection, Testing and calibration of 2 Floating Suction Tanks of size 30.5 m Dia x 12.5m ht., 2 Fresh Water Tanks of size 9.14m Dia x 7m ht. & 2 Disposal Water Tanks of size 16m Dia x 11.5m ht. – Total 6 Tanks.
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API 650 proved its versatility in tank design with Progressive improvisations & increased application worldwide

- 12th edition is in use from March 2013.

- Appendix B, E with new appendix EC (commentary on Appendix E), G, H, K, P, S with new Appendix SC (Covers mixed Carbon Steel and Stainless Steel), V, New Appendix X (Duplex Stainless Steel Storage Tanks) and Appendix Y(API Monogram).

OVERVIEW OF ASSOCIATED CODE

EN 14015 -2004 IS BRITISH CODE FOR STORAGE TANK REPLACES BS 2654 Similar to API 650, API STD 620 design and construction of large, welded, low-pressure carbon steel storage tanks vertical axis of revolution.
NEW TRENDS - Design Calculations

Traditional design methods, now improved with conversion of Manual calculations of API 650 on Microsoft excel sheets replaced by use of exclusively designed software

1. ETANK
2. TANK 2012 VERSION 4.0

- All these software incorporate the latest addendum of APIs 650 and 653 of the latest editions and can design supported cone roof design (Rafters, girders and columns), Seismic and wind design, Anchorage design etc.

- They cover venting requirements of tank as per API 2000 (inbreathing/out breathing and fire exposure).
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• Cylingas Preferred Method - Jacking
1. Sheet by Sheet Method/Conventional Method:
   Bottom and annular plate erection, then lower course shell erection, finally upper course

Advantages
   a. Suitable for all diameters and height
   b. Dimensional Control - Shell and bottom shape close to designed ones

Disadvantages
   a. Long duration of Erection/Construction
   b. Working at Heights (Safety Concern)
   c. More Resources Required
The technology of Swedish Company Bygging Uddemann AB where the Hydraulic Jacks are positioned inside the tank, the shell courses rest on Elevators.

- This is widely used in India, Europe, Far East, Middle East and is described at length in the presentation that follows:
**Brief Procedure for tank erection with Jacking method**

– Once Foundation of tank is ready, Annular and bottom sketch laid and welded
– Top 2 course are erected conventionally so as to accommodate Jack
– Curb angles/compression ring installed
– Cone Roof/CS Dome assembled on curb angle/Compression ring
– Roof plates, wind girders and other supports/platform to be installed
– Jacks arranged inside tank for lifting

[Number of jacks based on total weight of roof & shell courses except bottom courses. Span between two jacks to be kept approx. 3Mtrs. to meet additional wind load, number of jacks can be increased]
ERECUTION OF ANNULAR PLATE

ANNULAR PLATE

FOUNDATION

1

100

ERECUTION OF BOTTOM SKETCH PLATE

ANNULAR PLATE

FOUNDATION

1

100
ERECTION OF 9th to 10th SHELL COURSE PLATE

9th SHELL COURSE PLATE

BOTTOM SKETCH PLATE

FOUNDATION

LD 55000

10th SHELL COURSE PLATE

LIFTING ARRANGEMENT

LD 55000

50000

9th SHELL COURSE PLATE

BOTTOM SKETCH PLATE

FOUNDATION
TANK CONSTRUCTION - Jacking Process
TANK CONSTRUCTION With Jacking-up Technique

- **Roof and top shell** rings lifted hydraulically to height where the next course can be inserted

- **Courses fit up** and welded manually/ automatically

- All the **inspection (RT/MPT)** are done as per API Std 650/Approved ITP before next jacking
Further **shell rings lifted** hydraulically to height where the next course can be inserted sequentially.

**Spiral stairway** (with hand rail post and rail pipe) is erected bottom of the stringer to top, welded **with support** of bracket and stringer.

Other **supports and accessories** on top course are welded and inspected **before jacking up**.

**Cycle repeated** till completion of bottom shell course installed.
TANK UNDER ERECTION
INSTALLATION OF ALUMINIUM DOME ROOF

- WIND GIRDER
- LIFTING ARRANGEMENT
- 10th SHELL COURSE PLATE
- 9th SHELL COURSE PLATE
- BOTTOM SKETCH PLATE
- FOUNDATION
- ID 55000
ERECITION OF 8th SHELL COURSE PLATE

10th SHELL COURSE PLATE

9th SHELL COURSE PLATE

8th SHELL COURSE PLATE

BOTTOM SKETCH PLATE

FOUNDATION  LD 55000

LIFTING ARRANGEMENT

7500
ERECION OF 7th SHELL COURSE PLATE

10th SHELL COURSE PLATE

9th SHELL COURSE PLATE

8th SHELL COURSE PLATE

7th SHELL COURSE PLATE

BOTTOM SKETCH PLATE

FOUNDATION

LIFTING ARRANGEMENT
ERECTION OF 6th SHELL COURSE PLATE

10th SHELL COURSE PLATE

9th SHELL COURSE PLATE

8th SHELL COURSE PLATE

7th SHELL COURSE PLATE

LIFTING ARRANGEMENT

6th SHELL COURSE PLATE

BOTTOM SKETCH PLATE

FOUNDATION

1.D 55000
ERECCTION OF 5TH TO LAST SHELL COURSE PLATE

10th SHELL COURSE PLATE
9th SHELL COURSE PLATE
8th SHELL COURSE PLATE
7th SHELL COURSE PLATE
6th SHELL COURSE PLATE
5th SHELL COURSE PLATE
4th SHELL COURSE PLATE
3rd SHELL COURSE PLATE
2nd SHELL COURSE PLATE
1st SHELL COURSE PLATE

FOUNDATION
ID 55000

LIFTING ARRANGEMENT

BOTTOM SKETCH PLATE
REMOVAL OF JACKS

10th SHELL COURSE PLATE
9th SHELL COURSE PLATE
8th SHELL COURSE PLATE
7th SHELL COURSE PLATE
6th SHELL COURSE PLATE
5th SHELL COURSE PLATE
4th SHELL COURSE PLATE
3rd SHELL COURSE PLATE
2nd SHELL COURSE PLATE
1st SHELL COURSE PLATE
BOTTOM SKETCH PLATE

FOUNDATION
I.D 55000
• **Tank elevators** are removed

• **Bottom shell course** aligned properly to annular plates

• **Jacks dismantled** after completion of **welding of 1st shell course**

• In common with other construction techniques, **Hydro tests** done as per API & Client specification for any leaks and foundation settlement

• Aluminium Dome roof after erection is checked for leak, **by spraying water** as per API 650 appendix G.
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Falcon Project – Erection at Site
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ADVANTAGES

• Work at ground level- safe with lower risks, time saving and economical

• Better productivity, better quality, production of sound welds with welding carried out at ergonomic level

• Stage-wise weld quality inspection feasible with easy access

• Wind damage to shell while erecting, eliminated by the protective tank roof/wind girder at the initial stage.
• Tank plumb reading **within API 650 tolerances** easily achievable

• Less involvement of **high capacity cranes**

• **Scaffolding costs** held at minimum

• **Hydraulic jacks** connected to load by a **failsafe friction grip system**, saves tank if pump/ hose fails

• Tanks erected with jacks, **less susceptible** to collapse due to **high winds**

• Wind **girder/roof** in place, as the top shell is erected first

• **Gap** between the tank bottom and shell (350mm) allows **wind to flow** through the gap, reducing effects of the wind load on shell.
WHY JACKING-UP NOT ALWAYS A CHOICE ???

1. Erection of **column supported cone roof tanks**, not fully applicable; roof supporting structures and roof plates **need a crane for erection**

2. Large diameter tanks- \( \geq 90 \text{meter} \) with \( \geq 45 \text{mm} \) plate thickness double sided automatic **girth welding** needed to **expedite welding** of horizontal shell joints. Jacking up method only single sided welding can be achieved. Conventional erection method would be an option for higher speed of welding.

3. May not be fully feasible for **double wall tanks**

4. For diameter of **tanks less than 15meters**, jacking up method does not give significant advantage and therefore not recommended. Also for **diameter \( \geq 92 \text{meters} \)**, Jacking method is not adopted due to requirement of **higher capacity power pack** necessitating higher HP motor.

   **Sometimes, Mills are late to deliver low thickness which is required at beginning; hence we are flexible to either ways**
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THANK YOU