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1. **Introduction**  
*(Company Profile)*

**TPT Pacific (TPT)** has been established in Oct. 2000 under the name of AMT Pacific Co., Ltd. by the experienced engineers came out from SK Engineering & Construction Ltd., who used to work in the field of Mass Transfer Business such as design and fabrication of Tower Internals like tray & packing. The leading personnel of TPT Pacific have been conducting the successful business in Mass Transfer Equipments, Distillation System Design and Process Basic Engineering since 1989.
## 1. Introduction

### (History Summary)

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>Masstransfer Business team in SK E&amp;C has made the License agreement with Glitsch USA.</td>
</tr>
<tr>
<td>1997</td>
<td>Glitsch has been merged by the Competitor. Major engineers came out from Glitsch to establish AMT International in USA. SK E&amp;C and AMT Int’l have entered into an Agreement.</td>
</tr>
<tr>
<td>2000</td>
<td>Engineers from SK E&amp;C came out to establish AMT Pacific in Korea. AMT Pacific and AMT Int’l have signed the Agreement.</td>
</tr>
<tr>
<td>2003</td>
<td>AMT Pacific has built its own factory in Ulsan Korea.</td>
</tr>
<tr>
<td>2013</td>
<td>AMT Int’l has been merged by Beijing Zehua.</td>
</tr>
<tr>
<td>2015</td>
<td>Agreement between AMT Pacific and AMT Int’l is closed. AMT Pacific changed its name to <strong>TPT Pacific</strong>.</td>
</tr>
</tbody>
</table>
1. Introduction
(Key member’s profile)

The key engineers and fabrication leaders with 18~25 years of experiences in TPT Pacific have been working not only for the mass transfer equipments, but for revamping and process basic engineering for the distillation unit of the oil & gas, petrochemical, and chemical plants.
1.1 History Summary

- **2000**
  - Established AMT Pacific
    - Agreement with AMT International

- **2001**
  - Prized IT Communication for Small Company by Govt.

- **2002**
  - Established R&D Center
    - Opened fabrication shop
  
- **2003**
  - Built Own Factory in Ulsan
  
- **2004**
  - Member of Fractionation Research Inc.
  
- **2007**
  - ISO 14001:2004 Certificate
  
- Patent
  - Registered a Patent for “High Performance Perforated Tray”

- Prized for Favorable Small Company by Local Bank

- Prized Clean Shop by Govt.

- Patent
  - Registered a Patent for “Acetic Acid Recovery Method from PTA Process Oxidizer”
1.1 History Summary

- **MAIN BIZ**
  - Management Innovation Business Certificate

- **INNO-BIZ**
  - Innovation Business Certificate
  - Venture Business Certificate

- **2009**
  - Awarded Export Prospective SME Enterprises by Govt.

- **2010**
  - Awarded “Job World 600” by Industrial Bank (2011)

- **2012**

- **2014**
  - OHSAS 18001:2007 Certificate

- **2015**
  - TPT Pacific Starting with new name of the company
1.2 Organization Chart

Business Operation Division

Eng’g & Tech. Sales Team
Production Team
Quality Control Team
Management Support Team
Business Support Team
Mechanical Design Team

R&D Center

Research
Business Development
Market Development
2. Business Fields
- Mass Transfer Technology

- Oil & Gas
- Petrochemical
  - Process innovation
  - Optimum solutions
  - Cost effective design

- Environment
  - Environmental responsibility

- Energy
  - Energy-efficient solutions

Core Process Design
Core Equipment
3. Main Products
- Fractionation Trays

**Fractionation Tray**
- Conventional Valve Tray (TCV, TRV, TCVE, etc.)
- Fixed Valve Tray
- Sieve Tray
- Dual Flow Tray
- Bubble Cap Tray

**High Performance Tray**
- TDV, TCMV Tray, etc.

**Other Tray**
- Disc & Donut Tray
- Side to Side Tray (Baffle Tray)
- Liquid to Liquid Tray
3. Main Products

- Packings

**Structured Packing**
- TSP-64 X/Y, 85, 90, 125, 175, 200, 220, 250, 300, 350, 450, 500, 750, 1000, etc.
- Available in metal (sheet & wire gauze), plastic and ceramic

**Random Packing**
- TP-Ring, TC-Ring, TI-Ring, etc.
- Available in metal, plastic and ceramic

**Grid Packing**
- TGP-1,2,3,4
- TGP-F2, F3
- Available in metal
3. Main Products

- Packed Tower Internals

Liquid distributor
- Trough Type Distributor
- Riser Orifice Pan Type Distributor
- Pipe Ladder Type Distributor
- Spray Nozzle Distributor

Bed Limiter
- Bed Limiter
- Hold Down Grid

Packing Support
- Gas Injection Type Packing Support
- Grid Type Packing Support

Collector Tray
- Riser Type Collector Tray
- Chevron Type Collector Tray
4. Revamping

Objectives
- Increase capacity
- Improve purity
- Energy saving
- Reduce pressure drop
- Chemical recovery and/or pollution control
- Reduce fouling and/or clogging trouble

Type of Revamping
- Replace trays with high performance trays
- Replace trays with packing
- Replace packing with high performance trays
- Optimize existing tower internals
- Optimize the overall separation system
4.1 Revamping Case 1 - Isomer column

- **Original Design**
  - Tray Column

- **1st Revamp**
  - By other supplier
  - Trays to structured packing (lost separation performance)

- **2nd Revamp**
  - By another supplier
  - Structured packing type change & increase bed height (performance turned to be worse)

- **3rd Revamp**
  - By TPT Pacific

**Revamp target**
Increase capacity & improve purity

**1st Revamp**
Trays to structured packing (lost separation performance)

**2nd Revamp**
Structured packing type change & increase bed height (performance turned to be worse)
4.1 Revamping Case 1

- After revamp (by TPT Pacific)

![Diagram showing revamping process]

**New Column**
- Feed
- 114

**Existing Column**
- 110
- Heavy
- Light

High Performance Trays on 305 mm Tray Spacing
### 4.1 Revamping Case 1 - Performance summary

<table>
<thead>
<tr>
<th>Case</th>
<th>Before Revamp</th>
<th>Design Basis (Max)</th>
<th>After Revamp</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Trays</td>
<td>110 / SP</td>
<td>110 / 114</td>
<td>110 / 114</td>
</tr>
<tr>
<td>No. of Pass</td>
<td>2</td>
<td>2 / 2</td>
<td>2 / 2</td>
</tr>
<tr>
<td>Tray Spacing (mm)</td>
<td>305</td>
<td>305</td>
<td>305</td>
</tr>
<tr>
<td>Tray Type</td>
<td>Valve &amp; Structured Packing</td>
<td>High Performance Tray / High Performance Tray</td>
<td>High Performance Tray / High Performance Tray</td>
</tr>
<tr>
<td>Feed Rate (%)</td>
<td>100</td>
<td>107.5</td>
<td>112.5</td>
</tr>
</tbody>
</table>

**Product Purities (wt%)**

<table>
<thead>
<tr>
<th></th>
<th>Heavy, Overhead</th>
<th>Light, Bottom</th>
<th>Tray Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.73</td>
<td>0.06</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>0.01</td>
<td>0.01</td>
<td>74.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>80</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 4.2 Revamping Case 2
- **Main fractionator (Refinery)**

<table>
<thead>
<tr>
<th>Background</th>
<th>Revamp Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>LGO Color (3.0 ASTM D1500)</td>
<td>LGO Color → Max. 2.0</td>
</tr>
<tr>
<td>HGO Color (over 8.0 ASTM D1500)</td>
<td></td>
</tr>
</tbody>
</table>

TPT Pacific proposed to optimize the tray design in Wash oil section, LGO/HGO fractionation section.
4.2 Revamping Case 2

- Solutions for revamp by TPT Pacific
& Performance result after revamp

**Revamp Solution**

Design Optimization
- Change number of passes
  (4 Pass → 2 Pass)
- Optimum outlet weir design
- High performance valve

**After Revamp**

Performance
- LGO Color (1.0)
- HGO Color (Below 4.0)
# 4.3 Revamping Case 3
- HP absorber (PTA Plant)

<table>
<thead>
<tr>
<th>Condition</th>
<th>PLANT A</th>
<th>PLANT B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Existing internal Water</td>
<td>Existing internal Water spray</td>
</tr>
<tr>
<td>Before revamp</td>
<td>High performance tray 1200</td>
<td>Random &amp; structured packing 4500 (kg/hr)</td>
</tr>
<tr>
<td></td>
<td>(kg/hr) 5~10 (ppm wt.)</td>
<td></td>
</tr>
<tr>
<td>After revamp</td>
<td>Structured packing 700</td>
<td>Structured packing 2500</td>
</tr>
<tr>
<td></td>
<td>(kg/hr) N.D.</td>
<td>(kg/hr)</td>
</tr>
</tbody>
</table>
5. Column Scanning

Gamma Ray Scanning
Scan the column during operation
Outside the insulation
Using computer controlled apparatus

To Verify
- Collapsed internals
- Fouling and/or clogging
- Flooding / severe weeping
- Uneven distribution

To Prepare
- Required internals and/or works prior to shutdown

<Diagrams from Gamma-ray Scanning>
6. Major Experiences

<table>
<thead>
<tr>
<th>Refinery</th>
<th>CDU / VDU</th>
<th>NCC</th>
<th>FCC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HOU</td>
<td>HDS</td>
<td>LBO</td>
</tr>
<tr>
<td></td>
<td>LPG</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Petrochemical / Chemical Plant</th>
<th>PTA</th>
<th>Acetic Acid</th>
<th>BPA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AN</td>
<td>AA</td>
<td>Oxo-Alchole</td>
</tr>
<tr>
<td></td>
<td>NPG</td>
<td>EB / SM</td>
<td>MMA</td>
</tr>
<tr>
<td></td>
<td>VAM</td>
<td>DMT</td>
<td>BTX / BD</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Etc.</th>
<th>Poly Silicon</th>
<th>CCS</th>
<th>Water Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FPSO</td>
<td>Ripple Tray</td>
<td>-</td>
</tr>
</tbody>
</table>

**<Major Client>**
KNPC, TAKREER, BASF, Amoco Mitsui Indonesia, Technip S&W, PTTGC, SK Innovation, GS Caltex, S-OIL, Hyundai Oil Bank, Lotte Chemicals, SK Chemicals, SK Petrochemicals, SKC, LG Chemicals, LG MMA, Kumho Mitsui, Kumho Petrochemicals, Hyundai Chemicals, Samsung SDI, Samsung Fine Chemicals, Samsung BP, Hanwha Total, Hanwha Chemicals, Hyosung, OCI, Solvay, SK E&C, Samsung Eng’g, GS E&C, Daelim Industrial, Hyundai E&C, Hyundai Eng’g, POSCO Eng’g, Daewoo E&C, etc.
7. Product Delivered Locations

Location
Korea, Japan, China, Taiwan, Thailand, Indonesia, Saudi Arabia, Kuwait, Qatar, UAE, Turkey, Iran, Pakistan, France, Romania, USA, Mexico, Nigeria, Uzbekistan, etc.
8. Process Design Technologies

8.1 Mass transfer process basic engineering

- BTX Sulfolane Extraction
- Butadien Extractive Distillation
- LPG Extraction (Amine)
- Acetic Acid Purification Unit
- PTA Acetic Acid dehydration Azeotropic Distillation
- Vinyl Acetate Monomer Distillation
- LPG Recovery Distillation Unit
- Acrylic Acid Distillation Unit
- NPG (Neo Pentyl Glycol) Distillation
- 2EH (2-Ethyl Hexanol) Distillation
- EB/SM Distillation
- TDI, TDA Distillation
- MDI, MDA Distillation
- Acrylonitrile Distillation
- NCC Quench Column
- Butyaldehyde Isomer Splitter
- Aniline Extraction
- Acid Gas Absorption, Regeneration System (NH3) (Amine)
- Crude Distillation Column

Other Petrochemical, Chemical, Finechemical:
   Azeotropic, Extractive, Reactive Distillation, Extraction
8. Process Design Technologies

8.2 Acid gas removal process basic engineering

- Sulfinol Process (Petrochemical)
- Rectisol Process (Petrochemical)
- MDEA Process (Refinery, NCC, Petrochemical)
- DEA Process (FCC)
- MEA Process (Petrochemical)
- Benfield Process (Petrochemical)
- Ammonia (Steel Company)
- LPG-Amine Extraction (FCC)
8. Process Design Technologies

8.3 Divided wall column design

<table>
<thead>
<tr>
<th>Column</th>
<th>Energy saving (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N-BuOH Recovery Column</td>
<td>45 %</td>
</tr>
<tr>
<td>Oxo-alcohol Column</td>
<td>20 %</td>
</tr>
<tr>
<td>NPG Product Column</td>
<td>15 %</td>
</tr>
<tr>
<td>Biodiesel Column</td>
<td>$1 Million / Year</td>
</tr>
<tr>
<td>IPA Column</td>
<td>15 %</td>
</tr>
<tr>
<td>VAM Column</td>
<td>Capa. enhancing Investment cost saving</td>
</tr>
</tbody>
</table>

What TPT Pacific does?

- DWC modeling & simulation
- Optimum DWC design
- High performance DWC internal design & supply
- Column modification & internal installation consulting
- Liquid Splitter design & supply
8. Process Design Technologies

8.3 Divided wall column design

(Patent for “Non-moving Liquid Splitter”)
8. Process Design Technologies

8.4 Forward osmosis (Ammonium carbonate) semi-permeable membrane + distillation

- Desalination
  3.5% NaCl, 100 Ton/hr → 7.0% NaCl, 50 ton/hr
  ; Water Product 50 ton/hr, Steam consumption 10 ton/hr, 0.2 ton-steam/ton-water, 20 kg-CO2/ton-water, Chiller 2.5 MMkcal/hr, 20~25C

- Waste water treatment
  0.2% HoAc, 100 Ton/hr → 2% HoAc, 10 ton/hr
  ; Water Product 90 ton/hr, Steam consumption 20 ton/hr, 0.22 ton-steam/ton-water, 23 kg-CO2/ton-water, Chiller 5.0 MMkcal/hr, 20~25C
9. Research & Developments

DISTILLATION SYSTEM

EXTRACTOR SYSTEM

SHORT PATH DISTILLATION
9. Research & Developments

9.1 Developments

- New masstransfer device
- High efficiency & capacity
- Tray
- Packing
- Acid gas recovery system
- Solvent recovery system
- New process
- Energy saving & environment control
- Development
9. Research & Developments

9.2 R&D History (1/2)

- Grid Packing
- Structured Packing
- Trough type Liquid Distributor
- Fixed Valve (1) Streamline shaped Valve (1)
- Vapor / Liquid Contacting Device
- High Capacity Dual Flow Tray
- Liquid Splitter for DWC (3)

* 10 Patents for masstransfer device since 2001
9. Research & Developments

9.2 R&D History (2/2)

- Reducing method of water from reactor outlet gas in the oxidation process of Aromatic compound

- Apparatus for recovering CO2 from flue gas using NH3 solution

- Recovering method of acetic acid from the effluent of manufacturing of aromatic carboxylic acid by energy contributing distillation.

- Apparatus and method regenerating ammonium carbonate draw solution from forward osmosis semi-permeable membrane process

- Recovering method of acetic acid from reactor emission in the oxidation process of aromatic compound

- Phase separation absorbent composition for removing acid gas and removing method of acid gas

- Method for recovering acetic acid in preparing aromatic carboxylic acid

* 7 Patents for process
9. Research & Developments

9.3 Softwares for R&D and engineering

- Simulation program for process development
  PRO-II (Simsci, USA)
  Aspen plus (Aspen Tech, USA)

- Hydraulic program for mass transfer device development
  TPT Program
  FRI Program

- Mechanical engineering softwares
  STAAD PRO
  AUTO CAD
  SOLID WORKS

- Computational fluid dynamics (CFD): Out-sourcing
9. Research & Developments

9.4 Governmental R&D projects

- Energy saving divided wall column design
  TPT Pacific, LG R&D CENTER, YOUNGNAM UNIVERSITY

- CO2 capturing
  TPT Pacific, KIER
  TPT Pacific, RIST, POSCO
  TPT Pacific, KEPRI, Daelim Industrial, POSCO Engineering

- FPSO (Floating production storage and offloading)
  TPT Pacific, GS E&C
  TPT Pacific, Samsung Heavy Industry

- Water recovery
  TPT Pacific, KIMM (Korea Institute of Machinery & Materials)
9. Research & Development

9.5 Test facility for masstransfer devices

- Location: TPT Pacific, Ulsan, Korea
- Area: 100 M2
9. Research & Development

9.6 Laboratory for new process developments

- Location: Room #418, 3rd B/D of KIER, Daejeon, Korea
- Area: 61 M2
9. Research & Developments

9.7 Ulsan factory

- Land : 6,400 M2
- Building : 2,800 M2
Thank You
-The end-

Head Office
1st Floor, Hanaro B/D, 25, Insadong 5-gil, Jongno-gu, Seoul, 03162, Korea
Tel) +82-2-6356-2550 Fax) +82-2-6356-2565

Factory
19, Sannam-gil, Onsan-eup, Ulju-gun, Ulsan, 45010, Korea
Tel) +82-52-237-2720 Fax) +82-52-237-2721

Homepage & E-mail
www.tptpacific.com
tpt@tptpacific.com