



Institute of Brewing & Distilling Asia Pacific Section



 $\begin{array}{c} \textbf{ASIA} \\ \textbf{PACIFIC} \\ \textbf{PACIFICA } \\ \textbf{$ 

DISCOVER OURFUTURE



Institute of Brewing & Distilling Asia Pacific Section

## From Old "Rumble and Grunt" to State of the Art

John Hancock Technical Director Briggs of Burton PLC Paul Dowd Brewmaster Dr Scott Davies Business Development Manager



- New Mash tun at Cooley Distillery
  - "Exploring the past to discover the future"
- Old Mash Tun Technology
- Mash Tun replacement

**Contents** 

- Mash Tun size vs Capacity and Cycle time
- New Mash Tun Installation Project
- New Mash Tun Technology
- New Mash Tun Operation & Performance





## **Briggs of Burton – Overview**



#### **BRIGGS of Burton**

History in Burton-on-Trent back to 1740

- Brewing
- Distilled Spirits
- Food
- Pharma
- Biofuels



Burton on Trent, UK

Nantong, China

Part of CIMC Enric Group (CETP)

#### ZIEMANN HOLVRIEKA

- Brewing
- Dairy and Juice
- Chemicals

**Rochester**, New York

## **Briggs of Burton - Capabilities**



#### Capabilities

- Project Management
- Process Engineering
- Mechanical / Project Engineering
- Automation and Control
- Electrical Engineering
- Manufacturing



#### Projects

- Audits / Optimisation
- Concept / FEED Studies
- Detailed Design
- Project Implementation
- CDM + Health & Safety
- FSM HAZOP
- EPC / EPCM / Hybrid



## Cooley Distillery - Dundalk, Ireland



- The Cooley site was originally a Potato alcohol plant
- Converted to Whiskey production in 1987 John Teeling
- Both Malt and Grain Whiskey production Now part of Beam Suntory
- Grain Distillery
  - Continuous Mashing
  - Continuous Column Distillation
- Malt Distillery
  - Traditional Distillery Mash Tun
  - Two stage Pot Still distillation





## **Old Mash Tun Technology**



#### Traditional Distillery Mash Tun

- Reaching end of life
- No underplate flushing
- Sparge via Masher
- 5.8 Te Malt charge 32,000 L worts
- Manual operation
- Long Turn-around-Time 14 hours
- Low extract / alcohol yield

#### 4.57 m dia - Over 50 years old

 Cast Iron construction – St. St. lined



## **Old Mash Tun Technology**



#### **Porteus Steeles Masher**



## **Old Mash Tun Technology**



#### **Rumble & Grunt Mash gear**

- Originally Cast Iron
- Now partially stainless steel
- Geared drive in mash



## Mash Tun Upgrade or Replacement?



- Refurbishment / Upgrade or Replacement
- Mash Tun size & Design vs Capacity and Cycle time
- Space constraints Limited to similar size to existing 4.57 m dia
- Refurbishment / Upgrade Replace internals
  - Risks & cost in modifying old cast iron mash tun
- Replacement Tun
  - Traditional Semi-Lauter Distillery Mash Tun 5.8 Te / 7h
  - Full Lauter Distillery Mash Tun 3 Te / 4.5 h TAT

## Mash Tun Refurbishment / Upgrade



### **Refurbishment / Upgrade**

- Risks & cost in modifying old cast iron mash tun
- Traditional Semi-Lauter Distillery Mash Tun
  - 5.8 Te Grist
  - 32,000 L / 7 h TAT
- Full Lauter Distillery Mash Tun
  - 3 Te Grist
  - 16,000 L / 4.5 h TAT

#### **Alternative Upgrade Solutions**

|                   |                   | Semi   | Full   |
|-------------------|-------------------|--------|--------|
| Malt Grist Charge | kg                | 5800   | 3000   |
| Tun dia.          | m                 | 4.57   | 4.57   |
| Bed Loading       | Kg/m <sup>2</sup> | 354    | 183    |
| Mash Water Ratio  | L/kg              | 3.4    | 3.4    |
| Mash Water Vol    | L                 | 19,720 | 10,200 |
| Mash Vol          | L                 | 23,200 | 12,000 |
| Mash Depth        | m                 | 1.41   | 0.73   |

## Mash Tun Replacement



- Replacement Tun 4.5 m dia
  - Traditional Semi-Lauter Distillery Mash Tun 5.8 Te 32,000 L / 7h
  - Full Lauter Distillery Mash Tun 3 Te 16,000 L / 4.5 h TAT
- Confirmed as Full Lauter Distillery Mash Tun 3 Te / 4.5 h TAT
- Two recipes 16,000 L at 1060 gravity

|   | Recipe Grist - Te            |      | Mash<br>Water  | Wash<br>Vol | Wash<br>Gravity | Wash<br>ABV |       |     |
|---|------------------------------|------|----------------|-------------|-----------------|-------------|-------|-----|
|   |                              | Malt | Peated<br>Malt | Total       | L/kg            | L           | OG    | %   |
| 1 | 100% Malt                    | 3.00 | None           | 3.00        | 4               | 16,000      | 1,060 | 8 % |
| 2 | 72% Malt, 28%<br>Peated Malt | 2.16 | 0.84           | 3.00        | 4               | 16,000      | 1,060 | 8 % |



# **P&ID – Piping & Instrumentation Diagram** IG1915-P&ID-001

#### **User Requirement Specification - URS**

|   | 623          | Client: Cooley Distillery      |                      |        |  |
|---|--------------|--------------------------------|----------------------|--------|--|
| COOL CV                                     | Project:     | Distillery – New Mashing Plant | $\mathcal{O}$        |        |  |
|   | COOLET       | Ref:                           | MG1915-URS-001-Rev C | BRIGGS |  |
|   |              |                                | CONTENTS             | *      |  |
|   |              |                                | CONTENTS             |        |  |
|   |              |                                |                      | Page   |  |
| CIR   | CULATION     | RECORD                         |                      |        |  |
| AMENDMENT RECORD                            |              |                                | 2                    |        |  |
| DOCUMENTATION CONTROL                       |              |                                | 3                    |        |  |
| CONTENTS                                    |              |                                | 4                    |        |  |
| 1 INTRODUCTION                              |              |                                | 5                    |        |  |
| 2 PROCESS OVERVIEW                          |              |                                | 6                    |        |  |
| 3 PRODUCT RECIPES AND DESIGN DATA           |              |                                |                      |        |  |
| 4 AUTOMATION STRUCTURE                      |              |                                | 14                   |        |  |
| 5 GENERAL OPERATING / AUTOMATION PRINCIPLES |              |                                |                      |        |  |
| 6 GRIST HANDLING                            |              |                                |                      |        |  |
| 7 MASHING                                   |              |                                |                      |        |  |
| 8 MASH TUN WATER REQUIREMENTS               |              |                                |                      |        |  |
| 9   | 9 CIP SYSTEM |                                |                      |        |  |
| 10  | 0 APPENDICES |                                |                      |        |  |



#### **3D Model**

- Developed from P&ID & Mash Tun GA / Model
- Constrained site
- Good visualization
  - Allows review by
    Distillers & Engineers
  - Operability & Maintainability





#### Mash Tun Installation

#### **Grist Bin Installation**









Worts Cooler & Valve Manifold

#### **Lauter Drive**



## New Mash Tun Technology



- Full Distillery Lauter Tun
- Steeles Masher VSD controlled
- 4 arm Lauter Machine
  - VSD control of rotation & height
  - Stainless steel distillery lauter knives
  - Plough bar for draff out
- Machined Stainless Steel False bottom
- Tun bottom Briggs valley bottom effective drainage & balanced run-off
- Pulsed underplate flushing



## New Mash Tun Technology



#### **Automation**

- Mash Tun fully automated
- Defined in URS
- Detailed in FDS
- Siemens S7 PLC
- Siemens WinCC SCADA
- Integrated into existing site automation system



## New Mash Tun Operation

#### Operation

- Underplate Flood
- Mash-in VSD controlled Steeles Masher
- Conversion Stand & Recirculation
- Run-off & Sparge
  - 1<sup>st</sup> & ramped 2<sup>nd</sup> worts run-off to Washback 16,000 L
  - 3<sup>rd</sup> & last worts to HWT 1 / weak worts for mashing
- Drain
- Grain out & pulsed Underplate flush

Institute of Brewing and Distilling Asia Pacific Section

# Distillery Mash Tun Profile





## **New Mash Tun Performance**



| Aspect                           | Old Mash Tun                       | New Mash Tun                      |
|----------------------------------|------------------------------------|-----------------------------------|
| Diameter (m)                     | 4.57                               | 4.5                               |
| Туре                             | 'Rumble & grunt'/<br>Tumbling arms | Full Distillery<br>Lauter machine |
| Malt charge (kg)                 | 5800                               | 3000                              |
| TAT per mash (hours)             | 14                                 | 4.5                               |
| Time to fill 32,000 L WB (hours) | 14                                 | 9                                 |
| Efficiency (%PSY)                | ~ 85%                              | 101%                              |

## **Worts Clarity**

#### **Clear or Cloudy worts**

- Cooley distillery prefers to run bright worts to their Washbacks
- It has been proven at other sites that cloudy worts are achievable and controllable.
- This is achieved by adapting the rake control to judiciously stir up the mash whilst still maintaining run off rates and extraction efficiency



#### **Cooley New Mash Tun Worts Clarity**



#### Average Haze (EBC) to Washback

## Summary



- Old Distillery Mash tun
  - Over 50 years old and nearing the end of its useful life.
  - Manually operated with an old 'Rumble and Grunt' tumbling rake arm.
  - Overall a complete (5.8 Te) mash took 14 hours.
- The new Briggs Distillery Mash tun
  - State of the art, fully automated, new generation Mash tun with full Distillery lauter machine and integral Steeles masher.
  - Complete mash now takes only 4.5 hours with a smaller charge (3 Te).
  - Rapid batch operation, giving a 60% increase in capacity with clear worts and increased spirit yield.



Institute of Brewing & Distilling Asia Pacific Section



