Innovations in Secondary Smelting and Recycling Furnace Technology

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Topics covered today:

- Benefits of single chamber and double chamber furnaces
- The automation advantage: improving production times and safety records
- Retrofitting and upgrading at minimum cost and disruption
- Heat treatment processes for profiles, forging and flat products
**Single Chamber Furnace Re-melting Scraps**

- Heavy Clean Scrap
- Heavy Clean Scrap
- Medium Clean Scrap
- Cast scrap
- Heavy Clean Scrap
- Medium clean scrap
- Extrusion Scrap
- Typical single chamber melting furnace
- Briquetted Clean Scrap
Multi Chamber Furnace Re-melt Benefits

Light Baled Foil Scrap

Unshredded UBC Scrap

Shredded UBC Scrap

Medium/Light Sheet Scrap

Clean/Lightly Oiled Swarf

Briquetted Scrap
**Single Chamber Furnace Operation**

**Benefits**

- Heavy scrap melted in front of a direct flame
- Clean or lightly contaminated scrap only
- High hearth ratings for very fast melting
- High production
- Low dross formation
- Low fuel consumption
Single Chamber Furnaces – Top Loaded Furnaces

1. Rapid melting rates up to and over 40 tonnes per hour due to circular construction, burner firing configuration & fast charging of scrap from overhead buckets
2. Hence high production, low fuel consumption
3. Normally use an electro-magnetic stirrer underneath to enhance melting rate further
4. Require crane to lift lid and transfer to the side to allow charging
5. Require high capacity overhead crane to charge large quantities of scrap from a heavy bucket with lower opening doors
6. Require local pits under crane for 3 or 4 buckets waiting to be charged
7. Require space for park position for removed lid
8. High cost furnace, high cost building
TOP LOADED FURNACES

- High building roof
- High capacity overhead crane for scrap charging
- Lid lift crane
- Lid moved sideways
- Charge bucket with “bomb doors”
- Circular furnace construction

Melt rates of over 40 tonnes per hour
Capacities for 40 to 150 tonnes per hour
TOP LOADED FURNACES

Bucket loading location

Lid park location
FRONT LOADED FURNACES

1. High melting rates up to 25 – 30 tonnes per hour
2. High production, low fuel consumption
3. Normally use an electro-magnetic stirrer underneath to enhance melting rate further
4. Require charging machine for fast charging to reduce door open time
5. Require space for park/loading position for charge machine
6. Do not need high building
FRONT LOADED FURNACES

- Casting Machines
- Holding Furnaces
- Melting Furnaces
- Charging Machines
- Scrap Bay
Front Loaded Furnaces

- Single chamber melting furnace (Wide door type, high melt rate)
- Oversized chamber exhaust flue for some smoke
- All fumes extracted to fume treatment plant
- Regenerative burners

Capacities ranging from 30 Tonnes – 150 Tonnes
Melt rates ranging from 2 – 30 Tonnes/hour
Front Loaded Furnaces

Capacities ranging from 30 Tonnes – 150 Tonnes
Melt rates ranging from 2 – 30 Tonnes/hour
Tilting Rotary Melting Furnaces

Capacities ranging from 2 Tonnes – 30 Tonnes
Melt rates ranging from 1 – 8 Tonnes/hour
Sidewell Furnace

Components:
- Main chamber
- Side well

Materials:
- Medium gauge clean scrap
- Light gauge clean scrap
- Light contaminated scrap

Capacity:
Capacities ranging from 40 Tonnes – 200 Tonnes
Melt rates ranging from 2 – 15 Tonnes/hour
**Multi Chamber Furnace Remelting**

- Light or contaminated scrap indirectly melted away from burner flames

- Contaminated scrap preheated on dry hearth to burn off paints/lacquers/combustibles

- Cleaned scrap then pushed into bath for submersed melting

- Clean swarf and chips, delacquered shredded light scrap melted in vortex

- Molten metal pumped from fired ‘clean chamber’ to circulate through contaminated scrap melting chamber.
Multi Chamber Furnace Remelting – Cross Section
Multi Chamber Furnace Remelting – Contaminated scrap – Charging Sequence
Multi-Chamber – Vortex Melting Light scraps, clean/light contaminate

Chips & Swarf

Swarf pucks & briquettes

Light loose scrap

Mechanical or Electromagnetic pump circulation system for submerging and melting light scraps

Charge rates up to 12 Tonnes/hour
Automation & Control System

- **PLC** control system with plant-wide fibre optic data network
- **HMIs** for local operator control and visualisation
- **SCADA** system with remote analysis station for maintenance engineers
- Custom **Level Two** system to connect machines and operators direct to management through automatic, intelligent transactions
The Automation Advantage

Improve Safety Records
- Through assessing and addressing risks, we can better barrier areas of potential danger and in some cases remove operators altogether.
- Enable easier maintenance by leveraging available proven technologies.

Improve Production Times
- With in-built performance tracking capability, it is easier for machines to communicate with different levels of the business.
- Equipment status communicated more clearly can encourage quicker response to potential downtime issues.
The Automation Advantage

Effective Barriers

Barriers integrated into the machine control system allow context sensitive shutdowns to minimise production losses.

Removing Operators

Thoughtful automation of once manual tasks allows operators to stay away from areas of high risk.
The Automation Advantage

Performance In Mind
Building performance monitoring data into the core machine software enables more reliable data to higher level systems.

Communicating Clearly
Making key performance data clear to operators, maintenance engineers and management.
The Automation Advantage – The Future

Utilising Cloud Storage
Installing mobile data technology into electrical enclosures and harnessing the infinite storage capacity of the cloud combined with powerful analytical tools.

Context Awareness
Improving maintenance by using new technologies to provide dynamic context to user interfaces that provide both engineering materials and context sensitive HMI.
Rebuilding Aluminium Melting Furnaces

Melting furnace being rebuilt with new large single door
Rebuilding Aluminium Melting Furnaces

70 T melting furnace being rebuilt with regenerative burners
Rebuild/Replace Melting Furnaces

Pre-built furnace to enable faster build in shop and minimise down time
Rebuild/Replace Melting Furnaces

Re-built top loaded furnace with regenerative burners, new refractories and new control system.
70 T Plate Bogie Heat Treatment Furnace

- 12 zone reversing air flow recirculation system, +/- 3°C tolerance during soak
- Gas fired rapid heating design
- Internal controlled cooling system for 50°C/hr
- Pneumatically operated door lift, clamping and bogie sealing system
160 T Slab Bogie Heat Treatment Furnace

- Gas fired, 8 zone slab pre-heat & homogenising furnace up to 512mm thick slabs
- Centrifugal double discharge fan with high recirculation rates
- Hot bogie design
40 T/Hr Continuous Slab Pusher Furnace & Handling Gear

- Indirect radiant tube fired, 8 zone pusher furnace with handing gear
- Centrifugal double discharge fan with high recirculation rates
- Batch homogenising with integral cooling system
Forging Pre-Heat Furnaces

3 T/Hr continuous forging slab pre-heating furnace with automated loading system

Military specification fully automated conveyor hearth continuous forging slab pre-heating furnace
15 Tonne Capacity Foil Annealing Furnaces With Air Or Nitrogen Atmospheres and Multi-Station Charging Machine
Picture of 96 Tonne Coil Annealing Furnace With Nitrogen Atmosphere & Charging Machine

Coil Annealing Furnace Internals Showing Jet Impingement System
2x 45T GAS FIRED HOMOGENISING FURNACES & COOLING CHAMBER With CHARGING MACHINE
EXTRUSION TECHNOLOGY

- Log heater and hot shear or saw with automated pusher
- Billet heating furnaces
- Chest and rotary die ovens
- Batch and continuous Ageing ovens
- Skip stacking and transportation systems
- Gas fired taper heating units
Thank You