Choosing Your **Freedom® Furnace, Jet Melters and Infinity Melter**

Choosing between the Freedom® Furnace, Jet Melter and Infinity Melter can be a personal choice related to preferred design and consistency within a customer's overall operation. However, there some distinct difference which can help in making an informed choice.

Typical Shaft Melter Characteristics

- On demand melting is a major characteristic of all shaft melter and intrinsic to their efficiency.
- Energy recuperation of combustion energy through the charge shaft further enhances efficiency.
- Available in a range of sizes from 400 to 11,000 lbs/hr (~200 – 5,000 kg/h)
  - Sizes above these capacities create problems with the conventional shaftmelter elevator charging systems.
- Bath sizes are normally 1½ - 2 x the melting rate
  - Larger holding baths are proposed for fluctuating production demands
  - Higher holding temperatures require larger hold baths to avoid chilling effect of metal are available up to 44,000 lbs (~20,000 kg)
  - Best performance for standard sizes is at holding temperatures up to 720°C (~1,325°F).
  - Higher holding temperatures up to 1,470°F (~800°C) require larger bath sizes to avoid chilling and allow for superheat of incoming lower temperature metal from the melt hearth.
- Independent burner systems for melting and holding
  - Cold air medium speed burners on Infinity furnaces and Jet Melters
    - Freedom® Furnace has cold air melt burners and recuperated hot air holding burner with separate combustion air fans
- Charging shaft to accommodate fresh material and recuperate exhaust heat from combustion gasses
  - Ideal charge is a 50/50 mix of ingots and foundry returns.
    - Foundry returns should have a bulk density between 25 and 35 lbs/ft³ (~400 and 550 kg/m³). Max 47 lbs/ft³ (~750 kg/m³)
    - Higher density charges above 35 lbs/ft³ (~550 kg/m³) can block the shaft and cause back pressure in the melt chamber.
  - Charge shaft volume can be increased for low density charge material.
    - NOTE: this increases the overall installed height of the furnace and charge elevator.
- Charging elevator automation controlled from furnace operating parameters such as bath level and exhaust temperature.
  - Charging can be further automated with bin conveyors and shuttle systems
- Metal transfers options are available for all furnaces
  - conventional tap-out directly to ladle
  - by auto or hand ladle from integral pocket / dip-well
  - Pump transfer from attached pocket
  - Flanged connection to extended pockets and launder systems.

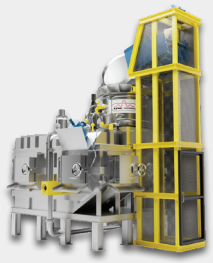
Specific characteristics and differences

Jet Melter and Micro Jet Melter

Sizing from 400 to 6,600 lbs/hr (~200 – 3,000 kg/h)

- Straight shaft is more amenable to the larger 35 lb (~16kg) US ingots. (Japan, China, Europe use a 6-8 kg (~13-18 lbFreed) ingot
  - Ingots may need to be oriented in smaller furnaces.
  - Accommodates higher density charge material better than choked shaft
  - Shaft can be extended for low density charges
    - Note: higher installation headroom needed
- Sizing from 400 to 6,600 lbs/hr (~200 – 3,000 kg/h)
- Holding capacity 1½ - 2x melting capacity.
- Cold air medium speed burners
- Dip-well pocket for ladle or pump metal transfers
- Ideal for die casting facilities with holding temperatures at or below 1325°F (~720°C).
  - Max holding temperature for larger sizes up to 1450°F (~780°C)
- Smaller sizes perfect for 'In Cell' installation
- NO TILTING OPTIONS AVAILABLE

Freedom® Furnace



Patented holding chamber design greatly reduces oxidation

- The Freedom® Furnace is the low oxidation evolution of the original Jet Melter furnace
- Exceptional cleaning frequency of more than 6 months for the holding chamber (melt chamber is cleaned daily as normal) when operated at 1325°F (~720°C) or lower hold temperature.
  - NOTE: higher holding temperatures up to 1450°F (780°C) are possible but with significantly increased oxidation in the holding chamber.
- Flat flame holding burner uses heated combustion air via separate exhaust recuperation
- Cold air medium speed melting burners
- Independent combustion air fans.
- No tilting options available

INFINITY Shaft Melter

Available in stationary or tilting versions

- Standard dip-wells or external pockets options for stationary versions only.
- Shaft Melter with 'choked' shaft to dispense charge material and optimize recuperation of exhaust gasses from holding and melting burners.
- Sizes from 1,000 – 11,000 lbs/hr (~450 – 5,000 kg/h) melting capacity
  - Smaller shaft / choke sizes (<1,000 lbs/hr – 450 kg/h) generally incompatible with US ingots sizes
  - The choked shaft of the infinity furnace increases the possibility of bridging.
- Holding burner exhausts through melting shaft to maximize energy efficiency.
- Maximum holding temperatures can be as high as 1,470°F (~800°C) for the Infinity melter and Jet Melter.
- Higher holding temperatures for the Freedom® furnace increase the oxidation potential and cleaning frequency.
- A range of options are available such as dip-out pockets, pump installation degassing plugs, launder connections etc.

Customer Situations or Requirements

Melting rate below 2,000 lbs./hr. (~900 kg/h)

- Jet Melter / Freedom® furnaces are more suited to US ingots with the straight shaft
- Larger US size ingots cause bridging in the smaller Infinity style choked shaft

High melting rate above 2,000 lbs./hr. (~900 kg/h)

- Infinity furnace from 2,000 up to 11,000 lbs/hr (~900 – 5,000 kg/h
- Jet melter or Freedom® from 1,100 up to 6,600 lbs/hr (~200 - 3000 kg/h)

Tap-out or pocket

- All furnace styles will work depending on required melting rate.
- Freedom® furnace offers better metal quality without additional filter plates
- Tap-out rates should be calculated to ensure that the melt to hold flow through is not exposed.

High transfer volumes / frequency

- Tap-out capacity is dependent on metal bath level and for ladles bigger than 500 lbs can take longer to fill with consequent temperature loss.
  - MMEI launder transfer pumps are recommended for high volume transfers
  - These offer faster fill rates and smoother lamellar flow reducing oxide inclusions.
- Tilt pour is independent of metal bath level and can fill transfer ladles faster.
  - High tilt pour frequency can reduce charging frequency and therefore impact melting capacity

High holding temperatures

- Freedom® furnace optimum operating (holding) temperature is 1,325°F (~720°C)
  - Holding up to 1,450°F is possible but the low oxidation characteristics are lost.
- Traditional Jet Melter and Infinity furnace can operate up to 1470°F (~800°C)

Die casting or sand casting

- Die casting operations generally need temperatures of 1325°F (~720°C) max and are ideal for the Freedom® furnace
- Sand casting and permanent mold operations generally require higher holding / casting temperatures up to (and sometimes above) 1470°F (~800°C).

Low density charge materials

- Charge materials that are large and light such as structural castings require an enlarged charge shaft to accommodate them
- Enlarged shafts can be incorporated into all furnace styles
- Jet Melter and Freedom® straight shafts will require higher extensions than the conical shaped infinity shaft for the same volume increase.
- Increases the charge height (cost) and necessary building headroom.

In Furnace Metal Treatment

Degassing

- Porous plugs can be installed in all furnace styles and / or bale-out pockets for gas level maintenance.
- Alternative rotary degassing units can be installed in pockets or launder systems.
  - NOTE: rotary degassing is approx. 4x as fast as porous plugs.
- Extended pockets incorporating rotary degassing can be supplemented with immersion heaters to ensure stable dip-out / casting temperatures.
  - The use of immersions also allows for lower furnace holding temperatures and superheat for optimum energy efficiency.

Modification / grain refining

- Modification – strontium is normally done in the transfer ladle after tap-out to improve fade time.
- TiBor grain refining can be added to the bath but more often in the ladle or holding furnace
- Analysis modification – alloying elements either raw or via master alloys added directly into the charge, into the holding bath or via the transfer ladle.
  - The melting process in shaft melting furnaces generally makes it difficult to add allying elements into the charge shaft and achieve consistent and uniform metal analysis in the holding bath
  - Can also be carried out in the pocket or launder system using master alloys and wire feeders.

Filtration

- Filter plate locations can be added to all external pockets.
  - Note: this will reduce the overall pocket length by 3”- 4” (75-100 mm).
- Filter plates are also insulating and can affect temperature differentials between pocket and main holding bath.

Fluxing

- Jet Melter and Infinity furnaces
  - Exothermic fluxes used daily (or per shift) to assist in cleaning the bath and melt chambers.
  - Fluxes should be used with a spray gun to optimize usage and ensure even coverage.
  - Cleaning fluxes can be used to clean the melt of suspended oxides only if necessary (inclusions in final castings) and should be rabbled into the melt using clean dry nitrogen. Never use shop air (usually has a moisture content)
- Freedom® Furnace
  - Minimal fluxing required for the holding bath surface.
  - Exothermic fluxes where necessary to clean the melt chamber and hearth on a daily basis.
  - When used at lower temperatures the use of an exothermic flux is limited to every 6 months or when build up is starting to appear on bath surface or walls.
- Modification fluxes are usually only necessary where removal of deleterious elements is required such as magnesium and alkaline earth metals contamination.