COMPARISON BETWEEN CHANNEL INDUCTION FURNACES & conticast GRAPHITE CONTAINMENT SYSTEM FOR PRODUCTION OF HIGH CONDUCTIVITY COPPER

CHANNEL INDUCTION	GRAPHITE CONTAINMENT
METAL QUALITY	
New start up channel furnaces with fresh linings require relatively longer periods of operational conditioning compared to graphite containment systems. The initial batches of materials (often several weeks production) take significant time to reach a product standard from both product cleanliness and/or conductivity requirements. The initial poor quality is due to impurity pick up from the new furnace refractory. Consequently the initial products are either rejected or have to be segregated for use only in lower quality products such as heavy gauge earthing conductors, house wiring etc.	A superior metal quality is produced with much less system conditioning from CONTICAST's GraphCC® graphite systems. Often a single system wash-thru' melt is all that is required.
REFRACTORY PROBLEMS	
Copper is relatively aggressive in nature, particularly when there is some oxygen present in solution. Channels have been known to often rapidly fail, even on adding the first melt to an awaiting and preheated channel. In use, the channel's condition must be regularly monitored for wear.	Copper is not affected metallurgically by containment in graphite.
METAL STIRRING	
The metal stirring caused by a channel furnace results in small temperature differences which can cause isotherm instabilities in the melt stream moving into the CC die ingate(s). This may result in variable product quality.	Continuous casting processes have been proven to be best served by static metal baths, where there are no movement streams to cause isotherm instabilities in the melt stream moving into the CC die ingate(s). Static baths such as in CONTICAST's GraphCC® graphite heated and melt contained systems are preferred.
START UP	
Channel furnaces require to be preheated for extended periods then filled with liquid metal at the correct temperature, in order to prevent problematic start up. This means a premelter of liquid metal is required of sufficient capacity to ensure that the channel system is completely filled, before powering the system up.	CONTICAST's GraphCC® systems can melt raw materials on start up without the requirement for preheating or pre-melter melt addition.
HOURS OF OPERATION	
It is critical that once a channel furnace is in operation, because of the potential start-up problems, the power integrity has to be 100%, often to the extent of either having to cast out to empty the system, and/or having a back up generator standing by to cut-in if the main system fails to keep the system molten. The equipment is therefore in operation for 24 hours per day, 7 days per week, 52 weeks per year which is very costly.	CONTICAST's GraphCC® furnace can be emptied completely and switched off. It can then be re-started without any problems. The annual electrical fuel cost savings are therefore significant. The CONTICAST system can also recover from power cuts without the absolute requirement for a back up power system.
STOPPAGE TIME	
Channel users have extra expense if, for productivity reasons, they wish to keep a complete body including inductor assy etc standing by in case the refractory fails. If the latter, it has to be knocked out, and repairs can be of a relatively extended or long period. (Knock out and rebuild is required)	CONTICAST's GraphCC® can easily recover from most breakdowns within normally 1 – 3 days max. The technology is operationally very robust.
FURNACE EFFICIENCIES	
The furnace energy efficiencies of a channel furnace and a graphite containment system are similar i.e. natural radiated heat loss plus water cooling of inductor (or forced air) with channel vis a vis.....	CONTICAST's GraphCC® system - natural radiated heat loss plus water cooling of probes & busbars

CHANNEL INDUCTION	GRAPHITE CONTAINMENT

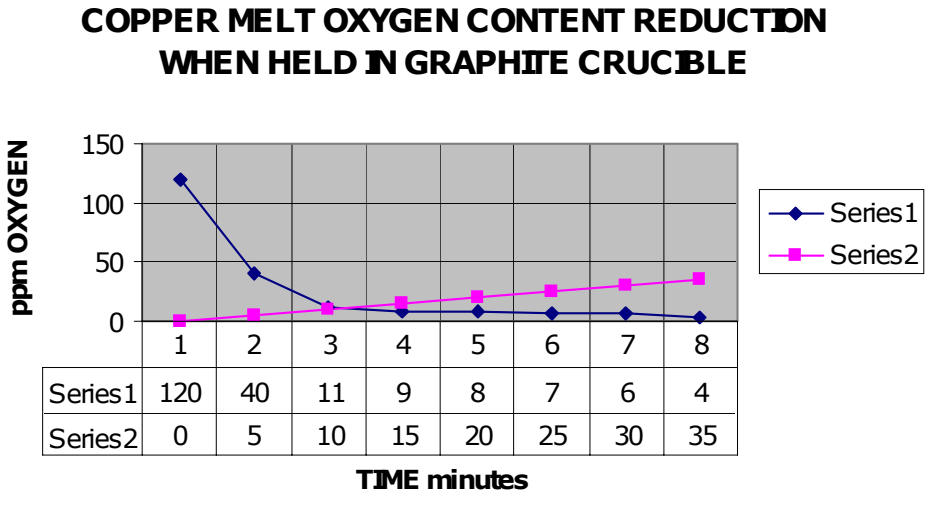
SIZE OF EQUIPMENT - TECHNOLOGY

Channel furnaces are older technology and in copper work, the critical de-oxidisation reaction of the melt, is only achievable from the melt's top contact with the carbonaceous cover. This is a relatively slow method of melt deoxidization and as such the system has to be constructed to hold a much larger volume of melt in order to give sufficient time for the melt to react out the oxygen at the melt -surface cover interface.**	**Most medium size plants now use graphite systems such as CONTICAST's GraphCC® which can be much smaller in size, due to the more rapid conditioning auto-deoxidation cycle of using lined graphite PLUS a carbonaceous cover. This results in the more rapid processing of the 'last in feed – first out metal' product through such systems.**** **** REFER TO THE FOLLOWING TAKEN FROM (courtesy INCRA) INCRA Monograph XI on The Metallurgy of Copper.**

TABLE 3.2.1

Calculated time to reduce the oxygen content of liquid copper to one tenth of its value, by reaction with carbon crucible or top cover.

Melt Size	Deoxidation at top (hrs)	Deoxidation at crucible (hrs)
10Kg	0.59	0.06
100Kg	1.30	0.14
1 tonne	2.70	0.31



BUILD QUALITY

Channel furnaces manufactured in Europe or the USA are normally of good quality, however, equipment manufactured in other parts of the World sometimes has variable build quality.	**Conticast equipment is built to the most exacting of EU standards using ISO 9000 series approved and specially selected principal subcontractors, six-sigma in-house philosophies and all CE marked input items, and electrical items from International sources.**

METALLURGICAL AND PRODUCTION EXPERIENCE

Some channel furnace manufacturers have good metallurgical and production experience - some do not.	**Conticast International personnel have many man years experience in this field, and are probably the best in-depth experienced metallurgical team in the world capable of handling continuous casting projects.**