

TUNDISH MATERIALS

The tundish is the last metallurgical vessel through which molten metal flows before solidifying in the continuous casting mold. Proper design, lining and operation of a tundish ensures less interaction with refractories, slag and atmosphere which helps to produce steel of desired composition and quality.



Basic structure of tundish

Tundish shell: It represents the outer bone of the tundish. This is made up of high performance manganese steel, which can withstand high temperature (m.p-1500°C approx). It has 25 mm to 30 mm thickness. Tundish shell structure is tapered from top to bottom which basically serves two purposes: one is to provide downward vertical momentum to molten steel for continuously casting and other is to facilitate easy de-skulling.

Evaporation holes in the Shell:- Tundish shell is having holes for the easy escape of the evaporated water during the time of drying. Absence of steam coming out of the holes represent completely dried out tundish.

S-S anchors with plastic caps:- Stainless steel anchors can withstand high temperature and has low thermal expansion. It is far better than mild steel anchors. The main purpose of the S-S anchors is to hold the ceramic fibre board and permanent lining of the tundish. Plastic caps fitted on tip of s-s anchors minimize the crack formation in the backup lining, compensate the expansion of the anchors and reduce the stress burden when expansion occurs at high temperatures. Anchors are placed at a horizontal distance of 250 mm and a vertical distance of 300mm from each other.



S-S anchors

Ceramic fibre board: - It is a alumino-silicate ceramic material which has high porosity and low thermal conductivity. It is used mainly as an insulation material to prevent abnormal increase of the tundish shell temperature and also prevents heat loss from the tundish pool. Holes are made in the fiberboard at a particular measured distance for indentation of anchors to take place.



Ceramic fibre board

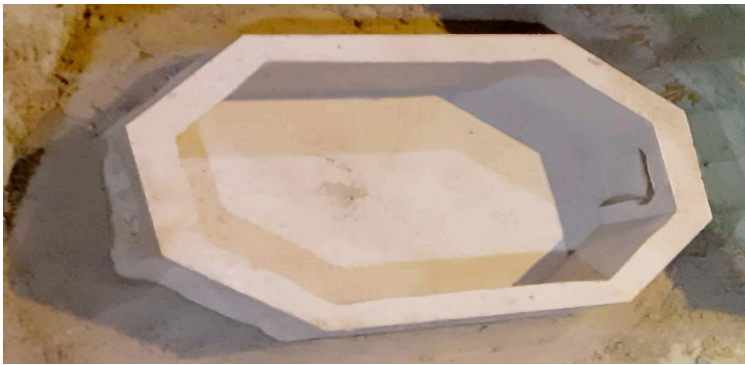
Permanent refractory lining: Low cement castables (LC-70) is generally preferable. In most cases monolithic, alternatively bricks can also be used. Normally monolithic permanent linings are used because of the absence of space between bricks and the better service performance. Monolithic linings can be applied as either thixotropic mixes, thickened by vibration, or free-flowing castables. Thus 70% alumina based vibratable castables are used. Anchors are welded to the tundish shell to keep the lining intact. A thickness of about 140mm and 180 mm permanent lining is applied on the wall and the bottom respectively. A newly made permanent lining has to be carefully dried and a proper drying pattern is to be followed for better results.

Well block: It is a PCPF material, made from low cement castable base materials. It is used before application of working lining for proper fixing and centering of SEN. After placing the well block into the tundish hole, the gap between the lining and well block is covered by ramming mass with 2% water which is meant to restrict well block movement and fill the microgaps present in the permanent lining of the tundish.



Well block

Turbo-stop: Turbulence inhibitor or commonly known as turbo-stop is a specially designed alumina base low cement castables. It is a pre-cast pre-fired(PCPF) refractory product which is placed over the impact plates or impact pads of the ladle stream. It homogeneously distributes volume of steel flow to all the strands. It also minimizes the erosion of the permanent lining in pouring area by reducing the molten steel turbulence and also directs the flow of steel upwards to enable capturing of non-metallic inclusions in the tundish surface layer.



Turbo-stop

Impact pad: An impact pad is placed underneath the turbo stop. The purpose is to resist the strong mechanical aggression by the steel stream when the turbo stop becomes worn out or damaged. The impact pad ensures proper sitting of the turbo-stop and equally distributes the impact pressure of the impinging metal stream on to the turbulence inhibitor. It is alumina base low cement castable PCPF refractory product.



Impact pad

Spray Mass: In most cases a basic spray mix is used for the working lining, with a composition that is chemically inert towards liquid steel. (Normally, 68% - 70%MgO which ensures longer casting duration).The working lining facilitates easy removal after rendering its service and is to be newly applied after every cast sequence. The thickness of the spray-gunned layer is about 40 mm in wall area and about 50 mm on the bottom. After spraying, the tundish should be dried as per the drying schedule.



Spray Mass

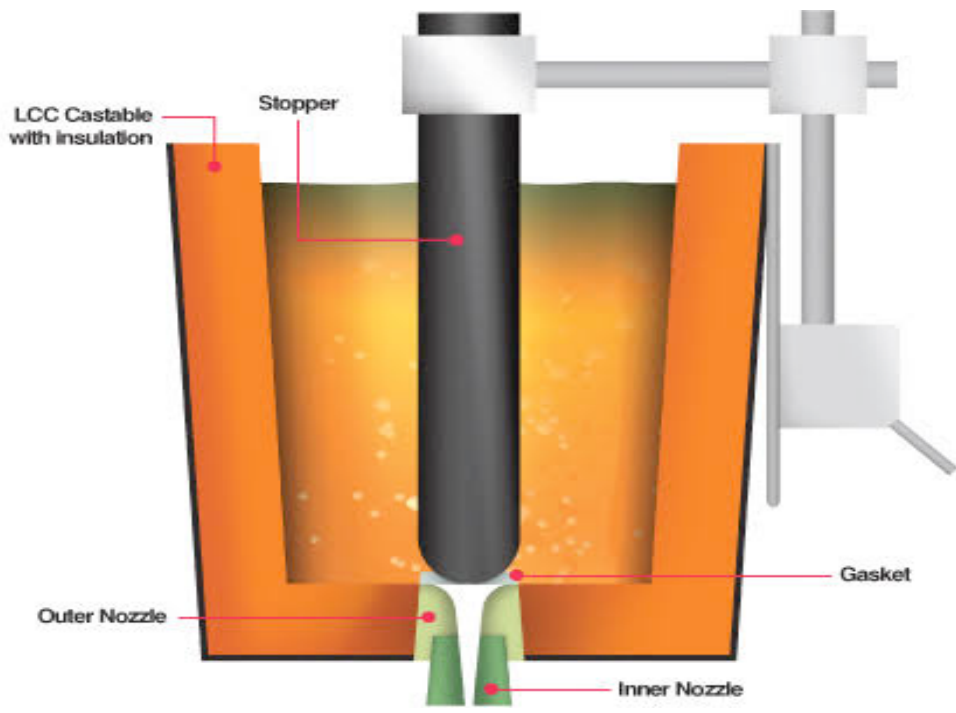
SEN: Submerged entry nozzles (SEN) is a refractory material which feeds the molten steel into the copper mold from the tundish. The body of the SEN is usually made up of alumina carbon of 20-25% C (94% graphite) and 70-75 % alumina(tabular fused alumina with mullite additions) while top part of the body consists of lower carbon and no zirconia while the slag line may contain 0-5% zirconia with 25%C.Antioxidants like Al, Si may be added to protect the carbon. Interior liner of low silica or carbon or high free lime may be added to prevent buildups. The body of the SEN is covered by ceramic paper to

prevent heat loss from the nozzle during the time of preheating and service. SEN helps to regulate the flow pattern of the molten steel in the mold. It also prevents the contamination of metal with air and minimizes the loss of heat to outer environment.



Submerged Entry Nozzle

MBS:- Mono block stopper is the special type of flow control refractory product which controls the flow of the molten steel into tundish. It is usually made up of Alumina graphite mix [20-25% C(94%graphite) and 70-75% alumina with mullite additions]. The tip is an area of high wear and will normally have zirconia or alumina for a standard tip but magnesia in case of high amount of calcium grades. The slag line composition is chosen to match the tundish slag composition and is basically alumina or zirconia or magnesia with carbon mix. Antioxidants like Al, Si may be added to protect the carbon. Sometimes permeability is ensured to promote optimum argon gas flow. Positive pressure is maintained inside the stopper to avoid air suction. The material possesses good resistance to erosion by steel and slag. The primary function of MBS is to regulate metal flow from tundish to the mold.



Mono block stopper