ACETARC

ENGINEERING

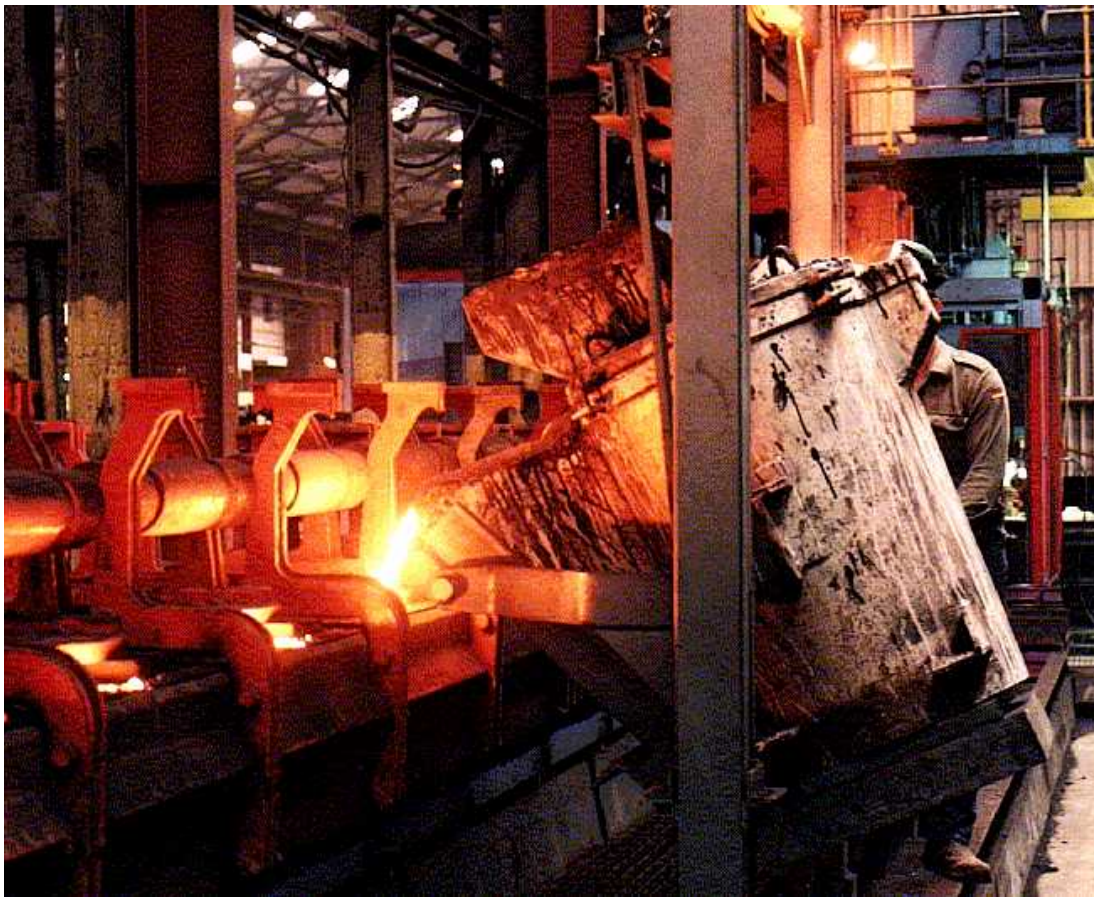
LIP-AXIS POURING

Lip-axis pouring ladles and lip-axis pouring systems

Acetarc Lip-axis ladles and Lip-axis pouring units

The following is a brief guide to lip-axis ladles and lip-axis pouring units manufactured by Acetarc Engineering. Please note that this equipment is designed and manufactured to suit each individual application. Therefore the following information is offered for general guidance and should not be taken as indicating the limitation of what can be offered.

It is intended to explain in general terms what they are, how they differ from other types of ladle pouring systems and the advantages that the lip-axis system offers when used for pouring molten metal.



A questionnaire is included at the end listing the typical information we require to offer a quotation for either a lip-axis ladle or lip-axis pouring unit.

Lip-axis pouring and lip-pouring ladles

Ladles are usually referred to by their method of pouring with the standard types being Lip-pouring, bottom pouring or teapot spout etc. The lip-axis ladle is a variation on the lip-pour ladle and is named due to the position of the pivot point being located at the tip of the pouring spout as explained in greater detail below.

Lip-pour ladles

A standard lip-pour ladle has a pouring spout on the rim of the ladle and the pivot point is located at a position that is approximately at the centre of the ladle body.

Lip-pouring ladles
Small un-geared and a large transfer ladle with motorised rotation and radio remote control operation.
With respect to the small ladle the pouring accuracy relies on the skill of the ladle operator where as the large transfer ladle requires a large target to pour into.

Therefore when the standard lip-pour ladle is rotated the position of the lip-pouring spout moves through an arc that has the radius that is the distance from the ladle pivot point to the tip of the pouring spout. If the ladle has an extended lip-pouring spout then this movement arc is obviously increased.

In many molten metal pouring situations this is not a problem and may have a benefit since it can allow a skilled ladle operator to have a significant pouring range in which he can pour moulds, especially if the ladle has an extended lip-pour spout.

However, this does require the ladle to be able to be raised and lowered at different stages of the pouring operation to adjust for the changing position of the ladle spout as the ladle is rotated. It also requires the ladle operator to be skilled to achieve quick and accurate pouring.

Even with skilled operators, there is a limit to how quickly a moulding box can be filled, especially as the casting size is increased. Therefore typically automatic moulding lines producing small castings may use two or more lip-pour casting ladles at the same time whilst moulding lines producing larger castings may have some form of auto-pour system to achieve the necessary through put of molten metal.

Lip-axis pouring
With a lip-axis pouring ladle or a lip-axis pouring unit, the ladle pivot point is moved to a position that is as close as is practical to the tip of the pouring spout. Therefore when the ladle rotates the position of the lip-axis pouring spout has very little movement and can almost be taken as fixed.

Lip-axis pouring

1 tonne capacity aluminium transfer ladle pouring into a small launder feeding an holding furnace

This gives a much more accurate pouring action than when compared to a lip-pour ladle, which allows the speed pouring operation to be increased whilst the operator does not need to have the same degree of skill as a lip-pour ladle operator to achieve good quality and consistent casting.

Powered Operation

The lip-axis ladle, due to the position of the pivot point relative to the centre of gravity of the ladle, has to have powered tilting and cannot be offered with a manually rotated gearbox like the standard lip-pour ladle.

However having powered tilt, when coupled with the accurate pouring means that the ladle operator can achieve quick and consistent quality casting on high speed moulding lines with a much reduced effort and skill requirement.

Small lip-axis ladles may use electric hoists or linear actuators for the lifting & tilting motions whilst larger units typically use hydraulic cylinders to cope with the increased loads.

Lip-axis ladle and lip-axis pouring unit

The term lip-axis refers to the pivot position around which the vessel holding the molten metal is rotated. Typically lip-axis vessels will be referred to as either lip-axis ladles or lip-axis pouring units. The pouring action is the same for both but, and with respect to Acetarc Engineering, we normally define the two thus:

Lip-axis ladle

A ladle with a lip-axis tilting action that is basically used in the same way as a lip-pour ladle in that the lip-axis ladle is filled at a furnace and is then transported to the moulding line where it commences casting.

When the lip-axis ladle is empty it is then returned to the furnace for re-filling. Typically the lip-axis ladle will be suspended from an overhead monorail or crane. If a monorail is used then more than one lip-axis ladle may be used at the same time.

Typically the lip-axis ladle capacity would be in the range of 250Kg -600Kg, although we have done larger.

The tilting speeds would be fixed with either just a single tilt speed or a standard and slow speed option

The lip-axis ladle would typically be offered with height adjustment to take into account different filling & pouring heights.

Power to the unit is provided via the overhead monorail or crane's bus-bar system.

Small capacity basic Lip-axis pouring ladles Used on an overhead monorail system. Each with simple push button controls.

The ladles each transfer between the furnace and the moulding line, with each ladle having it's own operator.
These ladles would be used as a direct replacement to standard lip-pouring ladles and would provide improved pouring accuracy

Lip-axis pouring unit

This term is generally applied to larger capacity pouring ladles that may be suspended from an overhead monorail system or be floor mounted on rails. It also tends to be applied to pouring systems that have more sophisticated controls and/or additional features such as PLC positioning control, variable speed tilt etc.

Therefore a lip-axis pouring unit can be offered with a range of features and each system is designed and manufactured to suit a foundry's particular set of requirements.

Usually the pouring ladle sits in a frame that actually provides the lip-axis tilt action. This allows the ladle to be removed from the frame. This can be expanded on so that the pouring ladle is taken to the furnace for filling whilst the tilting frame stays at the moulding line.

This type of system would typically have two ladles in use at the same time so as the empty ladle is being taken to be re-filled a second full ladle can be fitted into the lip-axis tilting frame thereby avoiding empty moulds.

Alternatively the pouring ladle stays in the lip-axis tilt frame and a transfer ladle is used to keep the pouring ladle filled. The pouring ladle can still be removed for maintenance purposes or if the metal in the pouring ladle cannot be cast and needs to be poured into ingots.

lip-axis pouring unit mounted on overhead gantry giving full x-x and y-y movement
The operator is positioned on the opposite site in a man riding cab

Positioning of the lip-axis pouring unit

Although some lip-axis pouring units can be used as static units with a fixed pouring position relative to the moulding line, most units are offered with the facility to travel along a section of the moulding line. Fixed position pouring units can obviously only pour directly into a mould as it is positioned in front of the pouring unit. The pouring rate is therefore fixed by the mould indexing rate.

Moving along the moulding line (X-X travel or long travel)
Pouring units that can move parallel to the moulding line (X-X travel) can not only be used to pour into the mould that would directly in front of them, at a fixed position, but can also travel along the moulding line pouring additional moulds, with respect to an indexing moulding line.

Having the X-X travel also gives the option of using a lip-axis pouring unit operating on a continuously moving moulding line where the lip-axis unit matches the speed of the moving moulding line so that the pouring takes place with the moulding line and lip-axis unit in synchronisation and the two are effectively stationary with respect to each other.

The additional moulds that are cast creates a buffer so that when the lip-axis unit has to stop pouring, for re-filling etc, this can be accomplished without un-cast moulds passing by the pouring unit.

Pouring moulds at a quicker rate than which they are presented to a fixed pouring point also means that the molten metal throughput is improved so that the metal is held in the ladle for less time. This can be very important if the ladle is being used to pour S.G. (ductile) iron.

The two usual methods of providing the X-X movement are:

- To have the lip-axis pouring unit suspended from an overhead monorail.
- To have the lip-axis pouring unit mounted on a car travelling on floor mounted rails.

Overhead Monorail/ Gantry Travel
The lip-axis pouring units can be mounted on either an overhead monorail system or a dedicated overhead gantry system to allow the pouring unit to move along the moulding line.

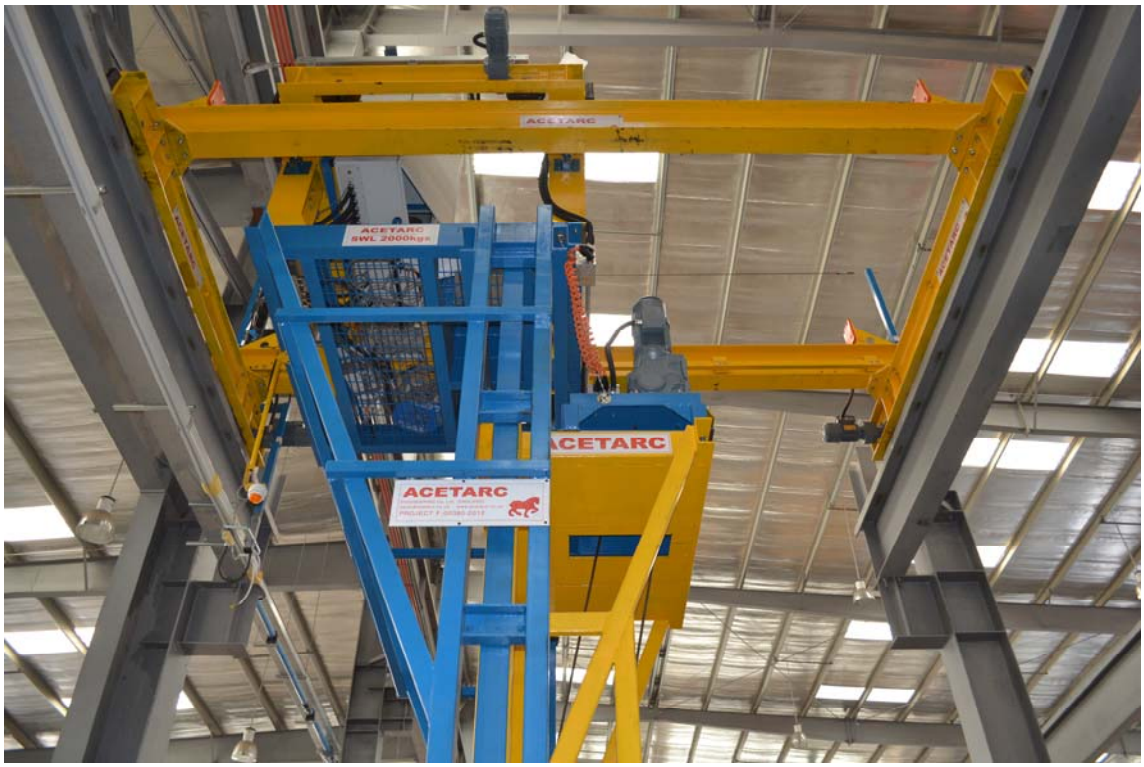
Typically the monorail will be an overhead track running parallel to the moulding line and may also include a maintenance spur for taking the lip-axis unit out of service should the need arise.

The monorail can be used to move the lip-axis ladle/pouring unit from the moulding line to the furnace but usually, with lip-axis pouring units, the monorail line is dedicated to serving the moulding line and the lip-axis pouring unit stays on station at all times.

The transfer of metal from the furnace to the lip-axis unit is either done by keeping the ladle shell in the frame and having it serviced via a transfer ladle or by taking the ladle shell out of the frame and using a secondary system to move the ladle shell between the furnace and the lip-axis pouring unit.

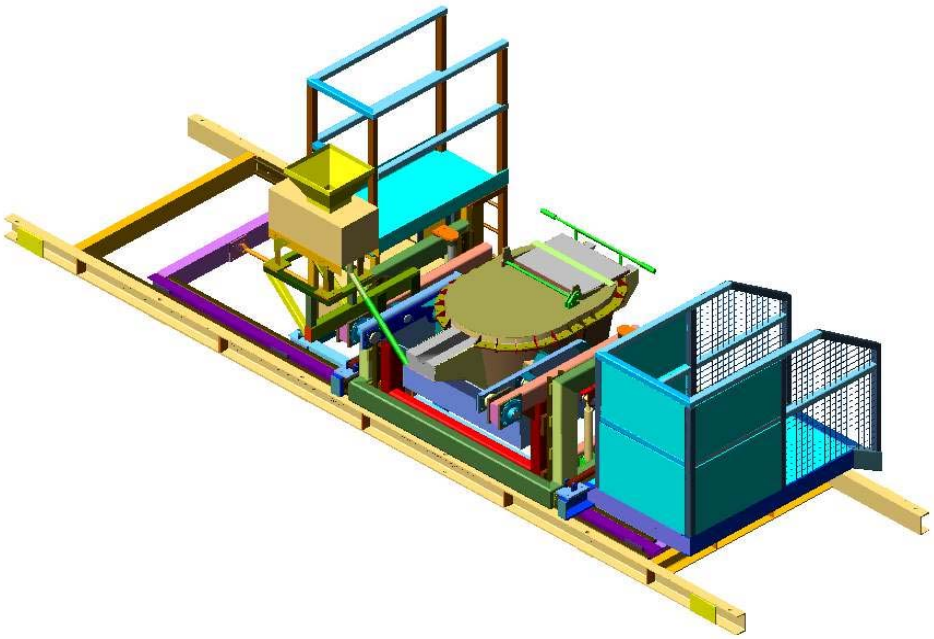
The operator can walk by the side of the lip-axis unit but will more usually, especially on units with high speed travel, ride on the unit on a guarded platform or enclosure.

Overhead mounted units can take their power supply from a bus-bar system mounted on the gantry or monorail system. This provides a neat and reliable solution for the power supply.



Floor mounted Lip-axis unit

The second usual method of moving the lip-axis pouring unit along the moulding line is to mount the lip-axis unit on a car that travels on floor mounted rails that run parallel to the moulding line. This can be offered for all sizes of unit but is especially applicable as the lip-axis unit increases in capacity and mass.



Having a 4 point contact on the rails, floor mounted unit gains greatly in stability
Typically the travelling car will include all necessary equipment for the lip-axis tilting including hydraulic power unit if the unit has hydraulic cylinders for tilting.

Floor mounted lip-axis units can take their power supply in a number of ways. Typically the power supply can come in via an overhead festoon system or floor mounted via a cable reeling drum or power chain system. Obviously the overhead system has the advantage of keeping the power feed up out of the way but it does come down to the client's preference and depending on the circumstances there may be reasons as to why an overhead power supply is not suitable in a particular instance.

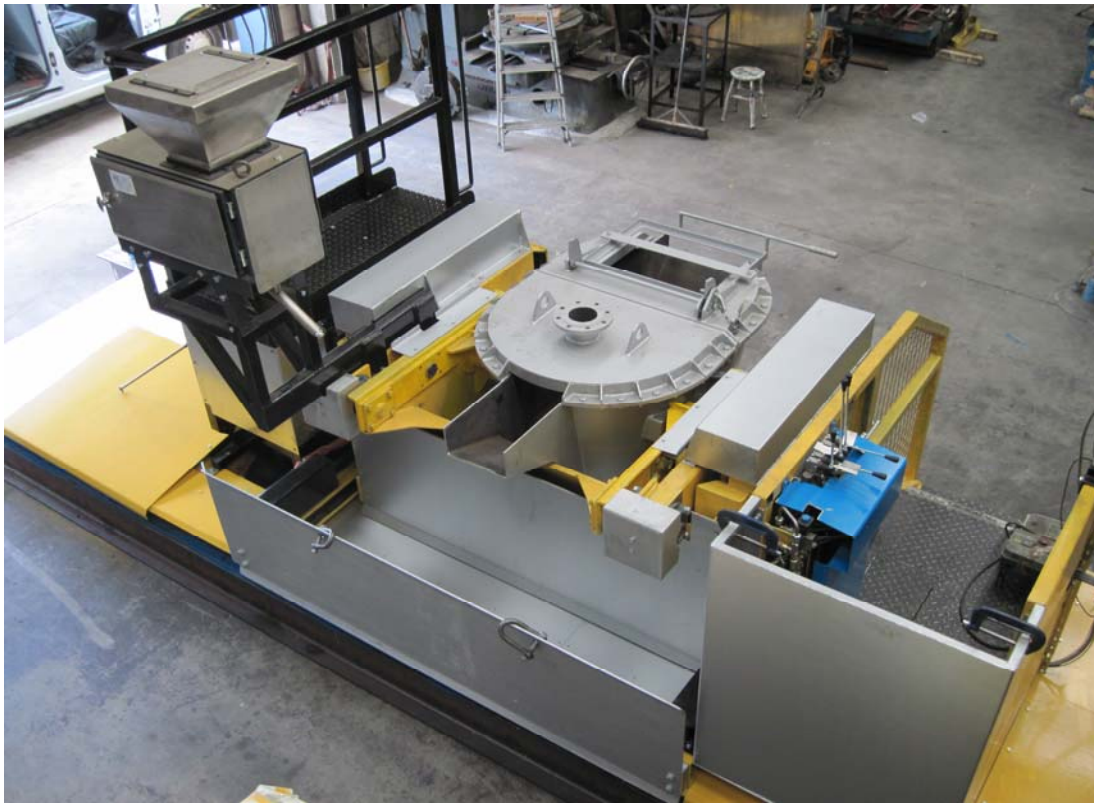
The car mounted lip-axis unit, in addition to the x-x travel, can also incorporate Y-Y travel and even vertical travel.

Y-Y movement

As explained above, the standard lip-axis pouring unit can move along the moulding line (X-X travel). The pouring position remains at a fixed position relative to the moulding line. This is satisfactory as long as the pouring cup in the mould remains in the same position in each moulding box and does not alter with a pattern change.

If the pouring cup position does vary with pattern changes then it may be necessary to design the lip-axis pouring unit to have the ability to move closer or further away from the moulding line so that the pouring position remains relatively constant to the pouring cup. This is referred to as Y-Y movement.

The floor mounted lip-axis pouring units can incorporate Y-Y movement much more easily than monorail mounted lip-axis units and this can be a significant factor in choosing a floor mounted system over a monorail mounted system.



Lip axis pouring unit with movement in all axis.
The unit is also fitted with a late stream inoculation feed unit.
The X-X movement is limited to 1000mm which matches the pouring positions on the automatic moulding line.
The late stream inoculation unit automatically pours additives directly into the stream of molten metal only when the ladle is being poured.

Z-Z movement (vertical movement)
Small lip-axis ladles, travelling between the moulding line and the furnace, need to be able to be raised and lowered to an optimum height for both the filling and the pouring of the ladle.

Lip-axis pouring units, for the reasons explained earlier do not need height adjustment to accommodate the filling and pouring levels.

However it is our experience that providing a small amount of vertical movement on lip-axis pouring units can greatly assist in maintaining quality and consistency in the pouring, especially if the pouring ladle has a teapot spout. This is because of the changing pressure head of the ladle as the ladle is tilted and the molten metal is poured. Basically the metal flow from the ladle spout will vary slightly depending on the degree of rotation of the ladle and the amount of metal in the ladle.

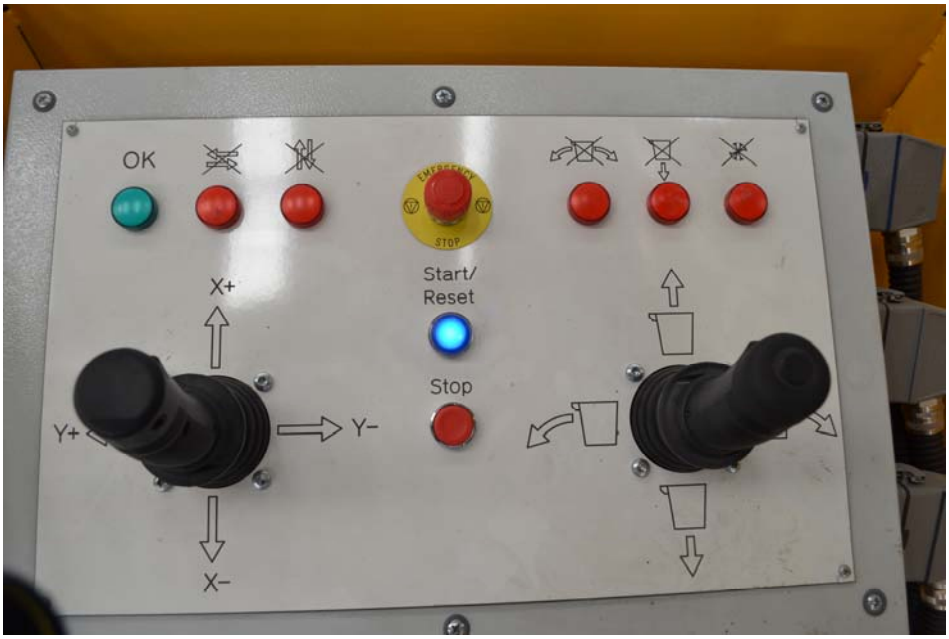
Having the ability to raise the lip-axis pouring unit allows the operator to compensate for this slight change in the path of the metal flow.

Incorporating vertical movement can also be useful if the mould height varies for whatever reason. For example if the moulding system uses a flaskless moulding process where the

moulds are made in layers or if some casting processes require the use of extended riser sleeves etc.

Controls

The lip-axis ladle is normally supplied with basic controls, typically push button pendant controls for either single or two speed tilt & raise/lower. If the lip-axis ladle is used on a monorail system the trolley can be either push travel or powered travel. If the trolley is powered travel then the travelling speeds are typically 2 speed with a standard and a slow speed.



The controls for the lip-axis pouring unit tend to be more sophisticated and are decided in consultation with each client to determine exactly how the system is to operate.

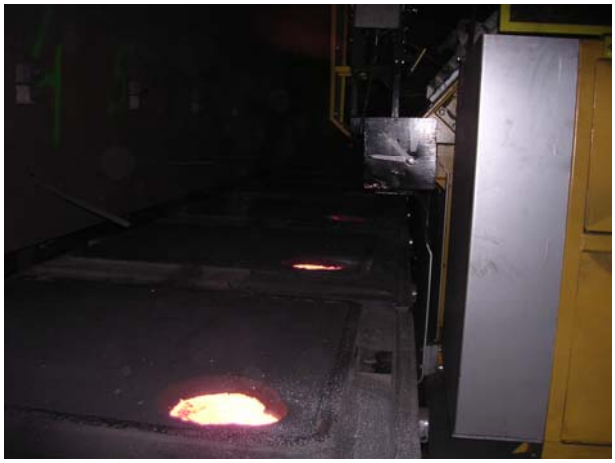
The tilt speed can have either fixed speed or variable speed operation. Variable speed tilt enables the operator to quickly rotate the ladle until pouring commences. The operator can then slow the tilting speed down to regulate the flow of metal into the mould. Then when the casting has been completed, the ladle can be quickly returned to the horizontal position.

The X-X movement can be offered with either fixed speed or variable speed control depending on what is required.

If the lip-axis pouring unit is required to track a moving moulding line then the X-X movement can be made to match the moulding line travelling speed with the ability to also increase/decrease speed for positioning on the next moulding box to be cast.

Typically where Y-Y and Z-Z movement is included in the system these will be on fixed speed push button controls but variable speeds can be provided.

Lip-axis pouring units can also be supplied with controls that interlock the unit with the moulding line so that moulding line indexing can be paused temporary so that all pouring is accomplished with the moulding line stationary. Thereby avoiding the possibility of molten metal spillage onto the moulding line conveyor.



Lip-Axis pouring unit in operation
Showing accuracy of pouring

Auto-pour ladle being
re-filled whilst in situ

Lip-axis pouring
Foundry commissioning

Loading stations

Where a lip-axis pouring system has the ladle taken out of the lip-axis frame and transported to a furnace for filling, before being returned to the lip-axis frame, it is usual to have two ladles in operation at the same time.

This lip-axis ladle shell is filled at the furnace and then transferred to the lip-axis pouring unit using an overhead monorail. The final transfer uses a special wheeled frame for moving the ladle across form the monorail and into the lip-axis pouring unit

One ladle is effectively travelling between the lip-axis unit and the furnace whilst a second ladle is in the lip-axis tilting frame. This way when the ladle in the frame becomes empty then there should be a full ladle ready to be loaded into the frame. This ensures that the pouring downtime is kept to a minimum.

Because there will be a point in the cycle where there is a need to take a empty ladle out of the frame and then place a full ladle into the frame a bottleneck could be created at this transfer point. Therefore it is common to provide a transfer station that quickly and efficiently allows an empty ladle to be replaced with a full ladle with the minimum of obstruction or delay to the system.

Lip-axis ladle shells

Where the same ladle is used for the transportation of metal from the furnace to the lip-axis pouring unit and is then used for the pouring operation the ladle can be offered with a number of options.

The ladle can be offered un-geared with fork pockets for fork lift truck handling. This is the most simplest but requires a FLT and the space to safely use it.

The ladle shell also can be designed to be used with a detachable lifting bail. This can be useful if an overhead crane is used to transfer the ladle from the lip-axis unit to the furnace and back when two ladles are in use at the same time.

Lip-axis pouring unit: Why you should have such a system one.

A Lip-axis pouring unit can be used as the primary metal pouring system for moulding lines where manual ladles would struggle to cope with the moulds per hour rate but going for a full auto-pour unit would not be cost effective.

A lip-axis pouring unit can also be used as a secondary pouring system to an existing auto-pour unit where the this need to either have an emergency back up pouring system or if there is a requirement to cast different types of metal that an existing auto-pour unit cannot cope with.

Therefore the main advantages can be summed up as thus:

The lip-axis pouring system offers quick, accurate and consistent pouring.

By controlling the tilting and travelling motions the skill level of the operator does not need to be as high as with a lip-pour ladle to achieve the same casting quality.

The physical effort is also removed from the operator so operator fatigue is removed

The lip-axis unit can be used with different metals
A lip-axis pouring unit can have quickly removable ladle shells as a standard feature. This greatly assists with maintenance operations but also allows the lip-axis system to be used with different types of metal without the risk of cross contamination. If the work in progress requires a different type of metal to be cast then it is relatively simple to change the ladle shell.

Questionnaire

To be able to offer accurate quotations for Lip-axis ladles and lip-axis pouring units it is necessary to know as much as possible about how the equipment is intended to be used and the general location of where the equipment is to be installed.

Answering some or all of the following will help us to assemble an accurate quotation.
In all cases an accurate GA drawing of the area where the equipment is to be used, including a cross sectional view of the moulding line is most helpful.

Lip-axis ladle

- What capacity of ladle do you require?
- How many lip-axis ladles do you require?
- What type of metal or metals will you be pouring?
- If you are pouring S.G. Iron, is there a time limitation in which the metal has to be poured?
- What is the typical weight of casting to be poured?
- What is the maximum and minimum weight of casting to be poured
- What is the work duty of the ladle (approximate number of hours used per day/ per week)?
- What is the height of the moulding line?
- Can you forward a sketch with the moulding box sizes?
- What is the distance from the edge of mould to the centre of the pouring cup?
- What is the filling height at the furnace?
- How is the lip-axis ladle to be transported between the moulding line and the furnace?
- Do you need any specific features with regard to the controls?
- If the lip-axis ladle is to be used on an overhead monorail, is this existing or is this to be supplied with the lip-axis ladle?
- How much headroom is available?
- If the monorail is existing then what is the height of the rail and size of the rail and the SWL of the rail?
- If the monorail is existing then what is the available power supply system?
- What is the voltage available?
- Does the lip-axis ladle trolley want to be push travel or powered travel?

Lip-axis Pouring unit

- What is the moulds per hour production rate of the moulding line?
- Does the moulding line index (stop/start movement) or continuously travel?
- If the moulding line indexes, what is the time cycle? (time the moulding line is stationary, time for the movement).
- What is the movement of the indexing line? (distance moved each cycle).
- If the moulding line is continuously moving, can the moulding line speed be varied or will it be a fixed speed and what will the speeds be?
- What is the distance from the edge of mould to the centre of the pouring cup?
- Can you forward a sketch with the moulding box sizes?
- Will the position of the pouring cup vary in the mould?
- Will the height of the mould change?
- What capacity of ladle do you require?
- What type of metal or metals will you be pouring?
- If you are pouring S.G. Iron, is there a time limitation in which the metal has to be poured?
- What is the typical weight of casting to be poured?
- What is the maximum and minimum weight of casting to poured?
- What is the work duty of the ladle (approximate number of hours used per day/ per week)?
- What is the height of the moulding line?
- Do you have a preference for a monorail mounted system or a floor mounted car & rail system?
- How is the lip-axis unit to be filled with metal? Is the ladle to be transported between the moulding line and the furnace or will a transfer ladle be used to fill the unit ladle?
- Do you need any specific features with regard to the controls?
- How much headroom is available?
- Are there any space limitations on site?

Any information that can be forwarded to us will be most helpful in assembling a quotation. Any information forwarded to Acetarc or their designed representatives will be dealt with in the strictest confidence and will only be used for the express purpose for which it was supplied to us.

Please note that the above text and accompanying photographs & drawings etc are offered for general guidance and may not be specific to your particular intended usage.

All systems are designed and manufactured to suit each client's specific requirements and can be tailored accordingly.

Do not hesitate to contact our design office if you have any questions regarding this matter.

Acetarc Engineering

Established in 1967, Acetarc Engineering is a family owned, ISO 9001 registered company specialising in the design and manufacture of foundry ladles, associated molten metal handling equipment and heavy-duty handling equipment for a range of other industries. Further details can be seen on our web site at **www.acetarc.co.uk**

Acetarc Engineering are the UK's longest established manufacture of foundry ladles and we provide a range of heavy-duty products, manufactured by craftsmen engineers, using long proven designs combined with the latest manufacturing techniques.

Our full design & manufacturing capabilities enable us to provide tailor-made solutions, from initial consultation, through to final design and manufacturing.

The design office uses AutoCAD and MS office. We are happy to exchange drawings via email and obviously respect a customer's confidentiality with respect to this.

We can be contacted at:

Acetarc Engineering Co. Ltd

Atley Works
Dalton Lane
Keighley
West Yorkshire
BD21 4HT
England

Tel: +44 (0) 1535 607323
Fax: + 44 (0) 1535 602522

Email: sales@acetarc.co.uk
www.acetarc.co.uk