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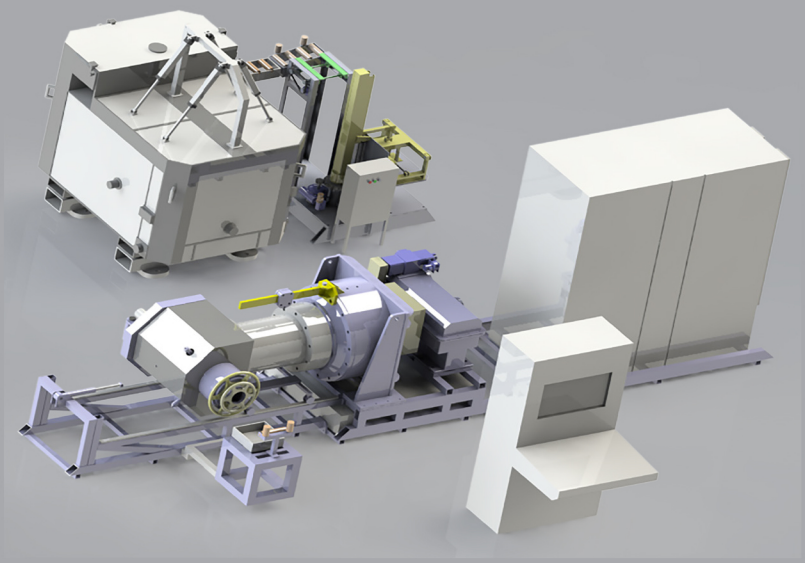
Technical Bulletin

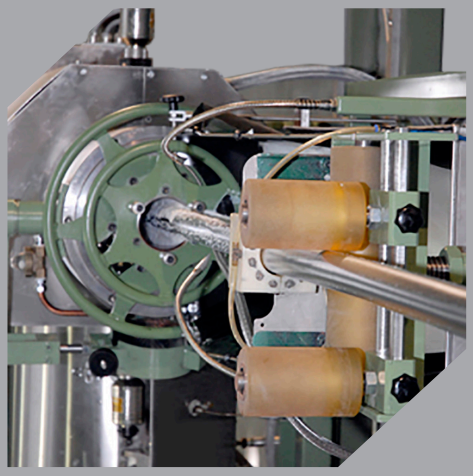
Continuous Lead Extruder



A **Continuous Lead Extruder** consists of several main components/units that are inter-connectable . These parts are mainly, Base frame, Gear Box, Die Block and Die Block tools such as Cartridge, Die and Nipple (Wire Guide), Screw and Screw housing, Thrust bearing assembly, Cooling system, feed pipe system, Melting pots and lead ingots delivery system and finally automatic computer control system.

As an end user and later as a designer and manufacturer of such extruders we have essential background to offer our know-how and technology.

Lead Extrusion process



• The process involves many parameters such as friction, metallurgical, extrusion tools design and selection like Die - Nipple, temperature and speed parameters …..

•Solid lead in the form of ingots (via lead feeding device) are loaded into the electrically heated melting pot, where it is heated to a temperature around 380 degrees centigrade.

•The melting point of lead is around 327 degree centigrade.

•The lead passes through the various zones (after being melted) of the melting pot and then to the gravity feed pipe, via the melting pot outlet valve.

•The electrically heated feed pipe allows the lead to pass through its omega construction to the straight inlet pipe and into the screw housing.

•Liquid lead is very hygroscopic and can pass through openings that water cannot penetrate. so when the liquid material arrives at the screw housing, needs to be made plastic before it can be transported by the rotating extrusion screw within the screw housing.

•To do this, regulated amounts of cooling water are applied to the three cooling zones of the screw housing.

• Once transportation starts ; the lead is forced at high pressure into the die block.

•The die block forms the lead into a tube as it passes through the extrusion Nipple (Wire guide) and then die.

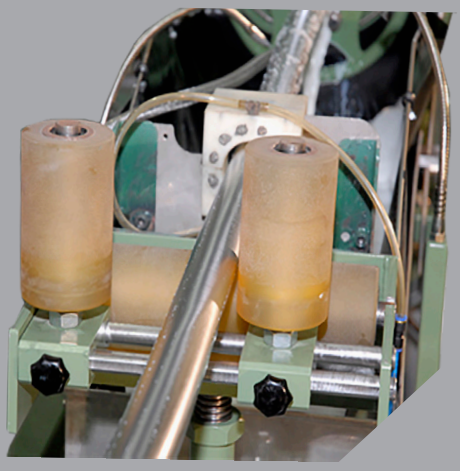
•As the lead is applied on the cable, the lead sheath shall immediately be cooled to prevent damage to the cable core (inner layers of cable).

•The concentricity and thickness of the lead sheath can be controlled within low tolerance range by use of the torque centering and hydraulic thickness adjusting device.

•From experience we can advise our customers on the type of lead alloy to use but the parameters will depend upon the machines mechanical condition.

Material : Lead Alloy E
Output : 16 ~ 18 Kg/Min

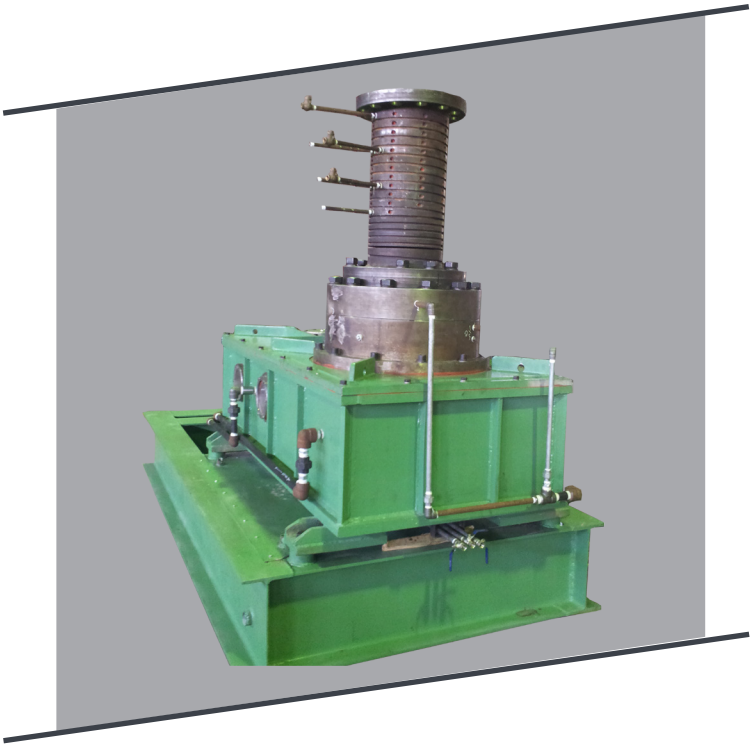
The machine is started by selection of the running menu from the panel PC touch screen and pressing the auto-start button. That's it, stand back and watch! Other functions of the system are included on-screen diagrams and allow printouts of operating charts. The predefined menu and the control system interface will control all temperature, extrusion speed and other functions.



Horizontal Lead Extruder vs **Vertical** Lead Extruder

We have both capabilities and expertise of making Horizontal and Vertical Lead Extruder.
However basic design of Lead extruder was Vertical type (a part of Melting system , gearbox , screw housing are installed vertically and under the ground level) ,
but still there are some advantages of this system such as lower required space for machine's installation and compacted design of machine comparing to horizontal lead extruder .
In horizontal extruder machine all main parts are located on the ground in direct access of operator and technicians, so troubleshooting and maintenance of machine will be very easy. Apart of these issues , the performance of output of both designs (Vertical and Horizontal) are the same.

Comparison Table		
Item	Horizontal extruder	Vertical extruder
Installation space	Requires more space as all frame and extrusion parts are on the ground	Saves space and more compact design
Maintenace and repair	Easier to repair as all parts are on the ground and accessibel	Takes more time to cessess and repair parts on base frame

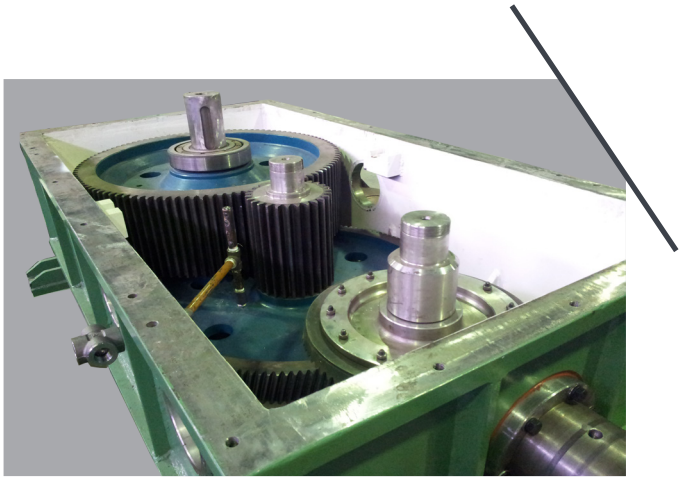


Base frame

The base frame is the main assembly unit for the lead extruder and brings together most of the machines mechanical functions. The base frame is divided into two units, the main frame and the extension frame with pre-assembled equipment for ease of installation.

GearBox

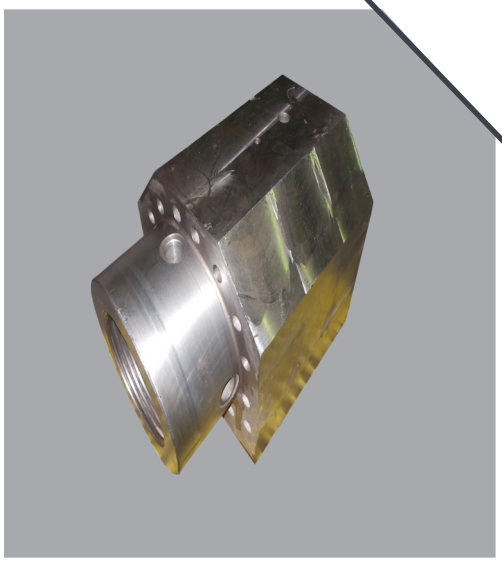
The main drive gearbox is manufactured from heavy gauge cast steel and contains gear transmission shafts and a closed circuit lubrication system.
The gear box is extraordinary strong comparing to other common cable extrusion machinery, in order to provide enough torque to push the lead into die block by means of screw.



DieBlock

The lead extruder can be equipped with various sizes of die block each with it's own specific range of lead sheathed cable's diameter. Here are some examples of cable diameters and Die Block types.

Die-Block's design is optimized to give a uniform flow of lead within the die block chamber and around the master core. The uniformity of this flow is dependent upon a uniform and accurate temperature profile too.



DIE BLOCK RANGE	
DIE BLOCK	Diameter Over Lead Sheath
Type(1) 9 inches	9 - 85 mm
Type(2) 11 inches	10 – 110 mm
Type(3)12 ¼ inches	50 - 125 mm
Type(4)13 ¼ inches	85 - 150 mm
Type(5) 14.4 inches	110 - 190 mm

Die, **Nipple** (Wire guide) and **Cartridge** are other essential parts of lead extrusion process.

Control of uniform and stable pressure is very important in achieving good results during the seam jointing process within the die block. Too low pressure (the seam is too weak) causes cracking in the lead sheath and too high pressure results in loss of output and possible segregation of alloying elements. The die block is equipped with 3 temperature controlled zones with the lower two zones providing both heating and cooling.

Extrusion Screw

The extrusion screw is made of solid alloyed steel construction and fitted with a bronze support bushing. The surface of the extrusion screw is coated with chromium for longer life span and low friction. The design of the extrusion screw is so that during its progression along the screw housing, no compression takes place upon the lead within it. Lead cannot be compressed. Although the screw housing is manufactured with a single angle taper, the extrusion screw is made with two taper angles to minimize screw and screw housing contact.

Screw housing

The screw housing is manufactured from two main components, the body and the liner. The liner is manufactured from special alloy steel, and machined with “U”-shaped grooves to grip the lead during its transportation by the extrusion screw. The inner surface of the liner is hard chromium plated to reduce friction and contamination. The screw housing body contains helical machined cooling channels within its body, and helical machined grooves on its outer surface for the electric heating elements. The heating system is divided into two controlled zones, and the cooling system is divided into three controlled zones. The accuracy and control of the screw housing temperatures is extremely important for the production of good quality lead sheaths at an optimum output.

Thrust bearing assembly

The thrust bearing assembly contains of a thrust bearing bracket, a thrust bearing housing and cover. The assembly is lubricated and cooled with oil, circulating through a heat exchanger to keep the temperature within desired limits.

Cooling System

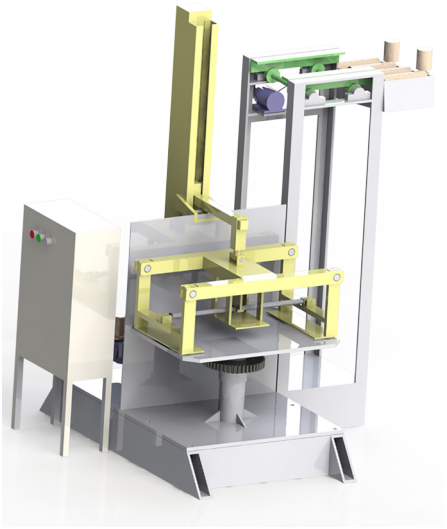
The cooling system is divided into two closed circuits. Within the main frame is the main tank of around 500 liters to process the water. This water should be distilled or treated to prevent calcium build-up in the screw housing cooling channels. To prevent pollution of the environment, all water that is used in the process is recycled. The primary sides of the heat exchangers are connected to factory’s water circulation system that is used to cool the tank water, and the factory’s water has no contact with the lead.

The water process system provides the cooling water for the screw housing and for the die block. The water is then returned to the water tank. A speed regulated pump regulates the water pressure and the water is distributed by proportional control valves to the screw housing and the die block. One pump circulates the process water through the main heat exchanger.

The primary side of the heat exchanger is connected to factory’s water that is used to cool the tank water. The primary water is regulated by a motor valve to maintain a constant closed circuit tank temperature. The circulation pump also provides water for the oil cooler and the hydraulic adjusting device.

Melting Pots and lead ingots automatic loader

There are three common sizes of melting pots, the 10 ton, the 18 ton and the 35 ton pots. 10 tons and 18 tons pots are connected directly to the machine, whereas the 35 tons pot is used as pumping station where the lead is pumped a long distance to a holding pot at the machine.
The melting pots are electrically heated and provides an efficient heat transfer to the lead within them. They also employ modern insulation materials and ceramics to minimize heat loss, thus maintaining efficiency and low exterior surface temperatures. The flow path of the lead within the melting pot has been carefully designed to allow as much time as possible for lead oxide and sulphides to precipitate to the melt surface.
Lead oxides have a specific gravity very similar to lead itself and so move slowly to the surface.
Total access to the melt surface for removing the dross is achieved by pneumatic actuated covers; these also totally enclose the surface when closed.



Automatic computer controlled system

A modern control system has been developed over a period of years and has proven it's capabilities through many stages of testing. In the past, the manual control system of a lead extruder has been sometimes difficult for operators, supervisors and maintenance to understand and handle. This has therefore resulted in bad starting, poor reliability and rejected cables. To simplify the starting, running and stopping of the lead extruder a modern sophisticated but simple to use , control system has been included as standard for all machines.

Lead Sheath in the Cable Industry




Lead sheath is the best cover and practice to protect the cable core from penetration of all fluids such as water, oil , … other contaminated water with chemicals that can be harmful for the cable and cabling system in two major concerns :

1- These fluids will damage the cable core, specially the insulation of conductors and finally age the cable and make it out of service much sooner than normal life cycle of cable (Normally its min 30 years)

2- Penetration of fluids to cable core, may be extended to whole cable run and ingress to switchgears and damage the electric parts and cabinets.

Lead Sheathed cables are widely used in Oil, Petrochemical plants and industry.
Most well-known standards are IEC 60502-1, 60502-2, 60840, 62067, EN 50288-7, ...

Based on 30 years experience on developing cable compound and wire processing (drawing, twisting, electroplating, ...) HONTA and Plexchem have introduced Contonuous lead extruder machine with innovative design .

HONTA Established in Sep. 2006, HONTA has long been committed to the technical research of cable conductor wire drawing and stranding. It has long-term friendly cooperation with many well-known cable companies at home and abroad, and established the second production base named HONTA INC. in the United States in 2017.

Plexchem Technologies Pte Ltd is an award winning Singapore based company which specializes in the manufacture and distribution of many proprietary specialty cable compounds. Plexchem strives to position itself as a leading supplier of innovative technology and materials to the cable industry..

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