SCREW-PLUG (BREECH-LOCK) HEAT EXCHANGERS

Screw-Plug (Breech-Lock) are proprietary design heat exchangers used in high pressure, high temperature, hazardous and dirty service typically found in oil refineries.

- Pressure range: 70 to 300 bar
- Temperature range: 250 to 500°C

Following are the typical processes where Screw-Plug designs are used.

- Hydro-cracking
- Diesel Hydrotreating
- Vacuum Gas Oil Hydrotreating
- Lube Oil Base Stock
- Hydro-dewaxing
- De-Sulphurization
- Gas compression
- Ammonia synthesis

1. Design Principle

![Figure 1: Principle of Screw Plug closure](image)

In the Screw Plug design, the thrust due to the tube-side pressure (H) is resisted by the channel barrel, which is transmitted through ACME threads. The bolts are provided only to generate the sealing pressure on the gasket. The bolt load (Hp) is applied exactly on the mean diameter of the gasket, resulting in effective sealing.

There are two constructions in Screw-Plug (Breech-Lock) heat exchanger design.

1. Hi-Hi (Removable Bundle)
2. Hi-Lo (Removable Shell)
2. Construction of Hi-Hi Screw-Plug Heat Exchanger

Generally, in Hi-Hi construction the pressures on both shell-side and tube-side of the heat exchanger are high.

The tube bundle of HH-SP-HX is designed for a specified differential pressure.

In this construction, the channel barrel is integral (welded) with the main shell, eliminating the external gasketed joints between the tubesheet and girth flanges of shell and channel.

The tubesheet is internally sealed (gasketed) at an annular shoulder between shell and channel.

The advantage of this construction is that the tube bundle can be removed without disturbing the process piping connected to the equipment. This design is also known as Bundle Removable type of Screw Plug Heat Exchanger.
3. Construction of Hi-Lo Screw-Plug Heat Exchanger

Generally, in Hi-Lo construction, the pressure on the tube-side of the exchanger is higher than on the shell-side.

In this construction, the tubesheet is integral with the channel and bolted to the shell.

Generally, in this construction, the shell is removable, and the tube bundle stays in its place. Hence it is also known as **Shell Removable** type of Screw Plug Heat Exchanger. Roller and rail arrangement may be provided below the saddle supports on the main shell, for ease of shell removal.

![Figure 5: Hi-Lo Screw Plug Heat Exchanger (tapped bolting)](image-url)
Figure 6: Hi-Lo Screw Plug Heat Exchanger (through bolting)

Figure 7: Cross section of Hi-Lo Screw Plug Heat Exchanger

Figure 8: Channel details of Hi-Lo Screw Plug Exchanger
4. Welded diaphragm

➢ Uses a welded diaphragm for sealing \((m, y = 0)\)

- Welding must be done with **alternate bolting installed/ removed**.

- The seal weld must be **GROUND-OFF** to open the cover. (Isolation Reqd.)

- Care to be taken to **preserve inconel buttering**, else weld will crack

➢ Hydrostatic end force resisted by bolts.

- **LARGE DIA. BOLTS** required.

- Difficult to tighten, **BOLT TENSIONER** required.

➢ Large bolt size and bolt area demands larger Flange OD and thickness

- **BULKY & EXPENSIVE**