



Akhyar Surgical Professionals

How Surgical Instruments Made

Surgical instruments manufacturing is based mainly on Hand skill work. The master craftsmen spend their lives to learn the art and then produce world class instruments.

❖ Material

First stage is the selection of material for a particular item keeping in view the required specifications. As discussed in my first post majority of the surgical instruments are manufactured from different Stainless steel grades. These grades for particular range of instruments can be found in standards like ISO 7153/1, BS 5194-4, AISI (F899).

❖ Stainless Steel Grades

Few examples of the grades used are:

Magnetic Stainless Steels

AISI 410 /410X: Used for Gripping Instruments like Forceps, Tweezers, Dressing forceps, retractors etc.

AISI 420A : Used for Cutting instruments like Bone Rongeurs, Chisels, Gouges, scissors with carbide inserts and Needle Holders etc.

Non Magnetic Stainless Steel

AISI 304: Used for Cannula, Clamps, Holders, Spreaders, suction tubes Speculums, Hollowware items like trays etc. Appropriate selection of the material helps in achieving the intended output of the manufacturing processes and the final required specifications.

❖ Manufacturing Stages:

Generally following are the manufacturing stages:

Forging: This is a simply a process for shaping metal parts through compressive forces either Hot or in Cold state. There are two types of forging processes involved in surgical instruments manufacturing i.e. Hand forging for small quantities orders and Hammer Forgings for bulk quantities.

Press work: After getting a crude shape impression in a piece of metal the excess material around that shape is cut off (trimmed) to get more desirable shape in the form of forgings.

Milling: Milling is a material removal process, which can create a variety of features on a part by cutting away the unwanted material by machining. Through milling, different features such as serrations, Ratchets, Male & Female box cuttings, different types of grooves etc. are produced in surgical instruments.

Grinding / Filing: These are material removing processes using different types of grinding wheels and files. This is a very critical stage in the instruments manufacturing because here the base for the general shape is produced using different types of gauges and the initial settings are done.



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Heat Treatment: Heat treatment is done to change the instruments physical and mechanical properties without changing the original shape and size like “Annealing” is done to soften the material and “Hardening” is done to Produce Hardness and “Tempering” is done to produce toughness in the instruments. Thus heat treating is a very useful process to help other manufacturing processes and also improve product performance by increasing strength or provides other desirable characteristics

Chemical Treatment: The main purpose of chemical treatment is to clean the surface of the steel parts and if carried out properly, they all increase the corrosion resistance. The main processes used in the surgical instruments manufacturing includes:

- **Pickling**

It is usually done after the heat treatment process to remove the scale formed because of oxidation. Dilute Sulfuric Acid / Nitric Acid is used for this purpose.

- **Passivation**

The passivation is performed when free iron, oxide scale, rust, iron particles, metal chips adversely affect the stability of the surface. Passivation consists of immersing stainless steel instruments in a solution of nitric or citric acid and sodium dichromate, dissolving the imbedded iron particles and restoring the original corrosion-resistant surface by forming a thin, transparent oxide film.

- **Electro Polishing**

Passivation also is accomplished by electro polishing. Electro polishing is an electrochemical process that is a super passivator of stainless steel and results in a more passive surface than the other methods mentioned above. The metal, which is electro polished gives a bright surface and appearance of metal looks fine. The second advantage is that some burr is also removed in this process. Most commonly phosphoric and sulphuric acids are used in conjunction with a high current density to clean and smooth (by metal removal) the surface of the steel.

Fixing: At this stage setting is done to align the instruments with proper functioning.

Polishing /Buffing: These are the metal finishing processes to produce different types of appearances like mirror or dull. Different abrasives are used on a work wheel to finalize the finish.

Checking/ Packing: The instruments are checked for desired specifications and sent for final inspection and testing before packing.

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