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By *Dr. M. Sayuti, ST.,M.Sc*

PRODUCTION OF CONDENSER

*(Mini Project Assignment during Ph.D at
Universiti Putra Malaysia 2008)*



Studi banding :
Carrier
A United Technologies Company



Dr. M. Sayuti, ST.,M.Sc

**JURUSAN TEKNIK INDUSTRI
FAKULTAS TEKNIK – UNIVERSITAS MALIKUSSALEH
2016**



Contents

- Objective
- Introduction
- Manufacturing Process and Machine
 - Fin Press
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OBJECTIVES

- To understand the production of condenser
- To identify the advance manufacturing system in the production of condenser



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INTRODUCTION



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**Heating,
ventilating,
cooling &
refrigeration
systems**

Carrier



Carrier

A United Technologies Company



The Factory



Carrier in Malaysia

Established in 1959

Bangi operation since 1985

ISO 9001 Certified since 1993

ISO 14000 Certified since 1999

ISO 9001:2000 Certified since 2003





FACTORY FACILITY



Assembly

- 6LC



- AHU/Chiller/WCPU



Coil Assembly



E-Coating

- Condenser Coil



06DR Compressor





















Powder Painting

- Power-coat line



TYPES OF PRODUCTS

	Ducted FCU			Cassette	UC/Console	Ducted CW FCU/AHU			
	42ZX (10k-36K)	40LX/LZA (40-200K)	40RQ (240K-360K)	40KMC (13K - 50K)	42XQ/42XQA (18K - 60K)	42ZM (300-1200)	40LM (1200-3400)	42D/C (200-2000)	39G
									
CONDENSING UNIT									
38VTA (30K - 60K)		✓	✓	✓	✓				
38LZA (80K-200K)			✓	✓					
AIR-COOLED RECIP CHILLER									
30GTN (50TR - 200TR)						✓	✓	✓	✓
WATER COOLED PACKAGE									
50BPB/BP, 50PVB/PV (80K-900K)									
50PH (40K - 60K)				50BPB/PVB (Scroll) 50BP/PV (Recip)					50PH
OTHERS									
	BUS 		OEM Coil 		E-Coat Compressor 				



NO OF EMPLOYEES

- The main production floor in CISB factory is operating 12 hours
- Some of the highly demand product such as condenser and compressor production is operating 24 hours in a day.
- Currently there are more than 600 workers working in the factory per day.



VOLUME PRODUCE/YEAR

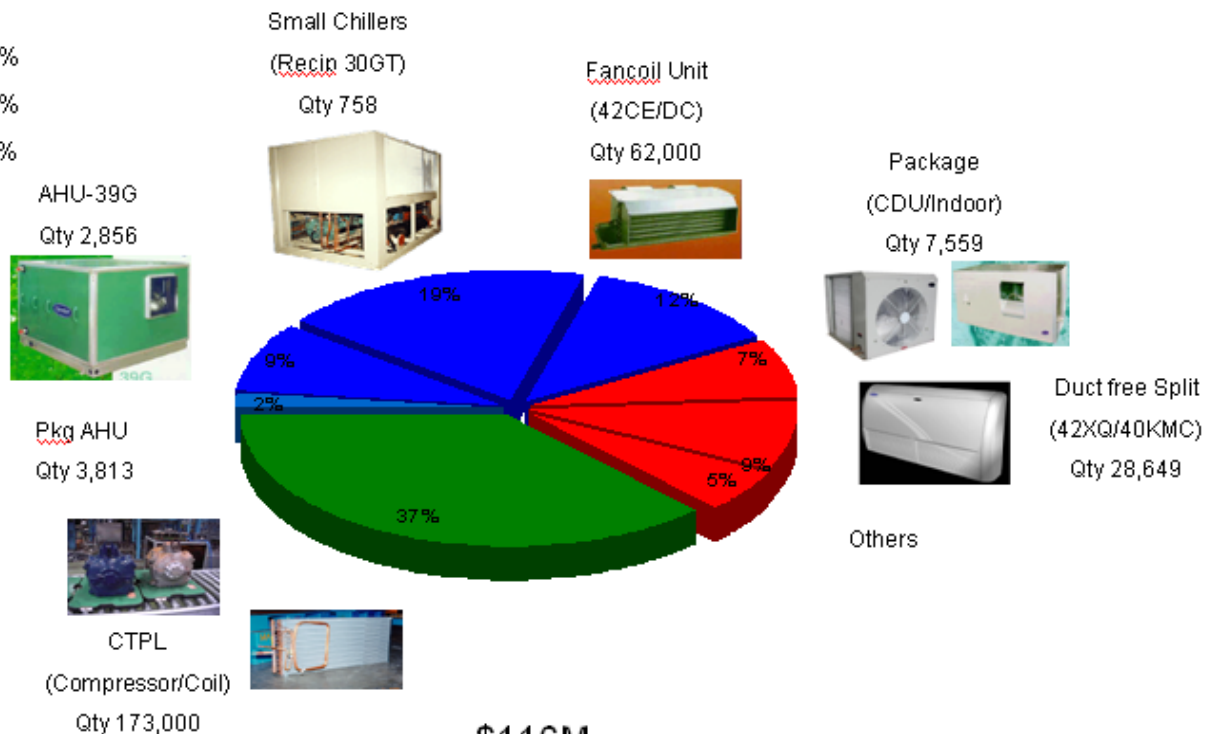
CARRIER INTERNATIONAL SDN BHD

2008

Product Portfolio 2008

(\$ millions @ 2007 pfx)

- BSS: 42%
- RLCI: 21%
- Ref: 37%



\$116M



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Manufacturing Process and Machine



TYPES OF MANUFACTURING

CHARACTERISTIC MANUFACTURING SYSTEM

- The Condenser line can be known as mass production
 - ~ *Around 400 pieces of condenser produce in a day*
 - ~ *More than 10,000 units of condenser product produces annually*
 - ~ *Mass production can be known as a flow production, repetitive flow production, series production, or serial production is the production of large amounts of standardized products on production lines.*



Factory Layout





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Condenser



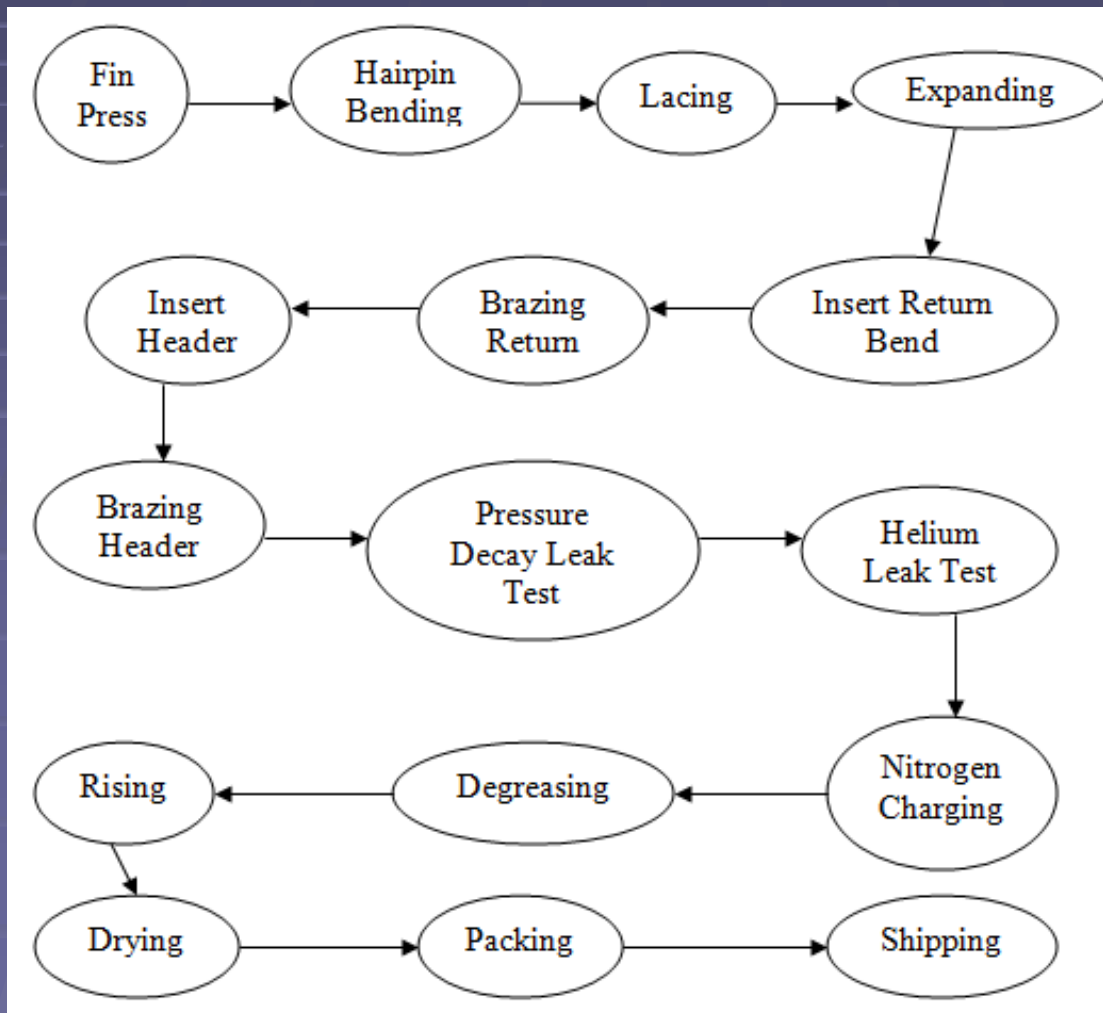


Condenser

- Condenser (heat transfer), a device or unit used to condense vapour into liquid.
- For example a refrigerator uses a condenser to get rid of heat extracted from the interior of the unit to the outside air.
- Condensers are used in air conditioning, industrial chemical processes such as distillation, steam power plants and other heat-exchange systems.



The Process Flow of Condenser





Process of Fin Press

- Is a process that transform the metal sheet to the condenser fin
- Process through a highly accurate and efficient machine using pressing method.



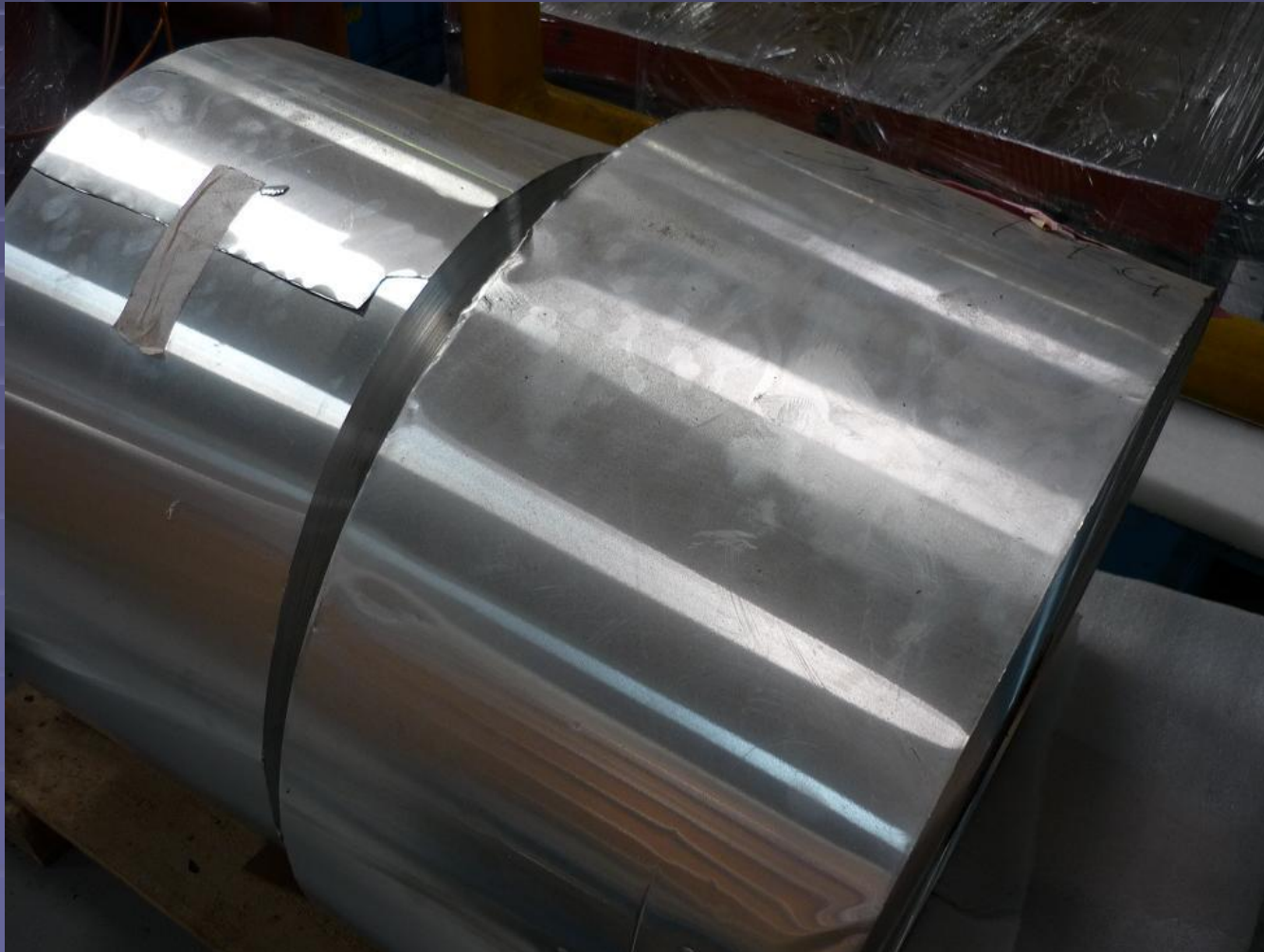
Process of Fin Press



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Process of Fin Press



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Process of Fin Press





Process of Fin Press

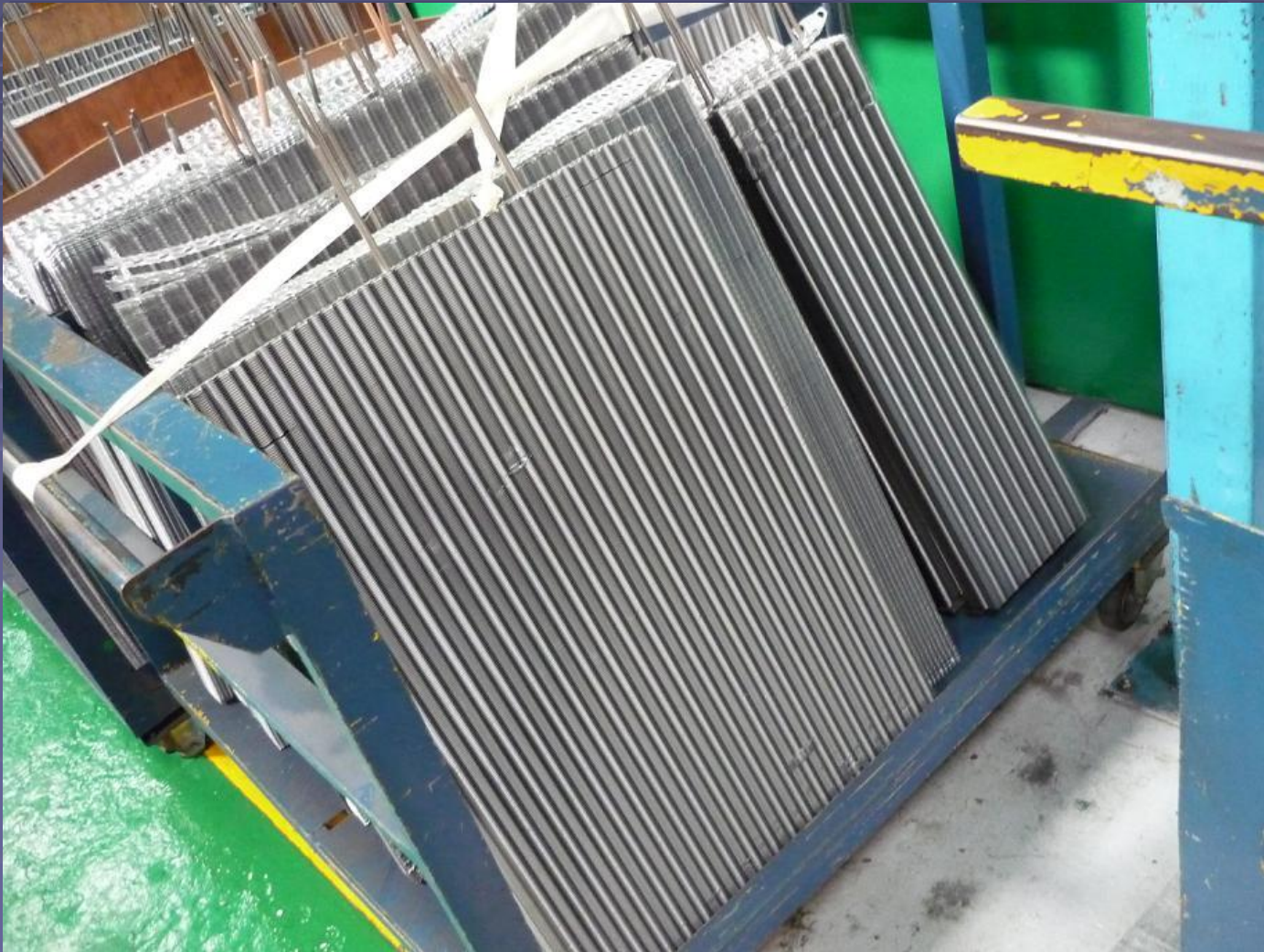




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Process of Fin Press





Process of Fin Press





Process of Fin Press







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Process of Hairpin Bending





Process of Hairpin Bending

- Is a process that transform the copper roll to the U shape Hairpin Bending
- Process through a highly accurate and efficient machine using bending method.



Process of Hairpin Bending



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Process of Hairpin Bending





Process of Hairpin Bending





Process of Hairpin Bending



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Process of Hairpin Bending

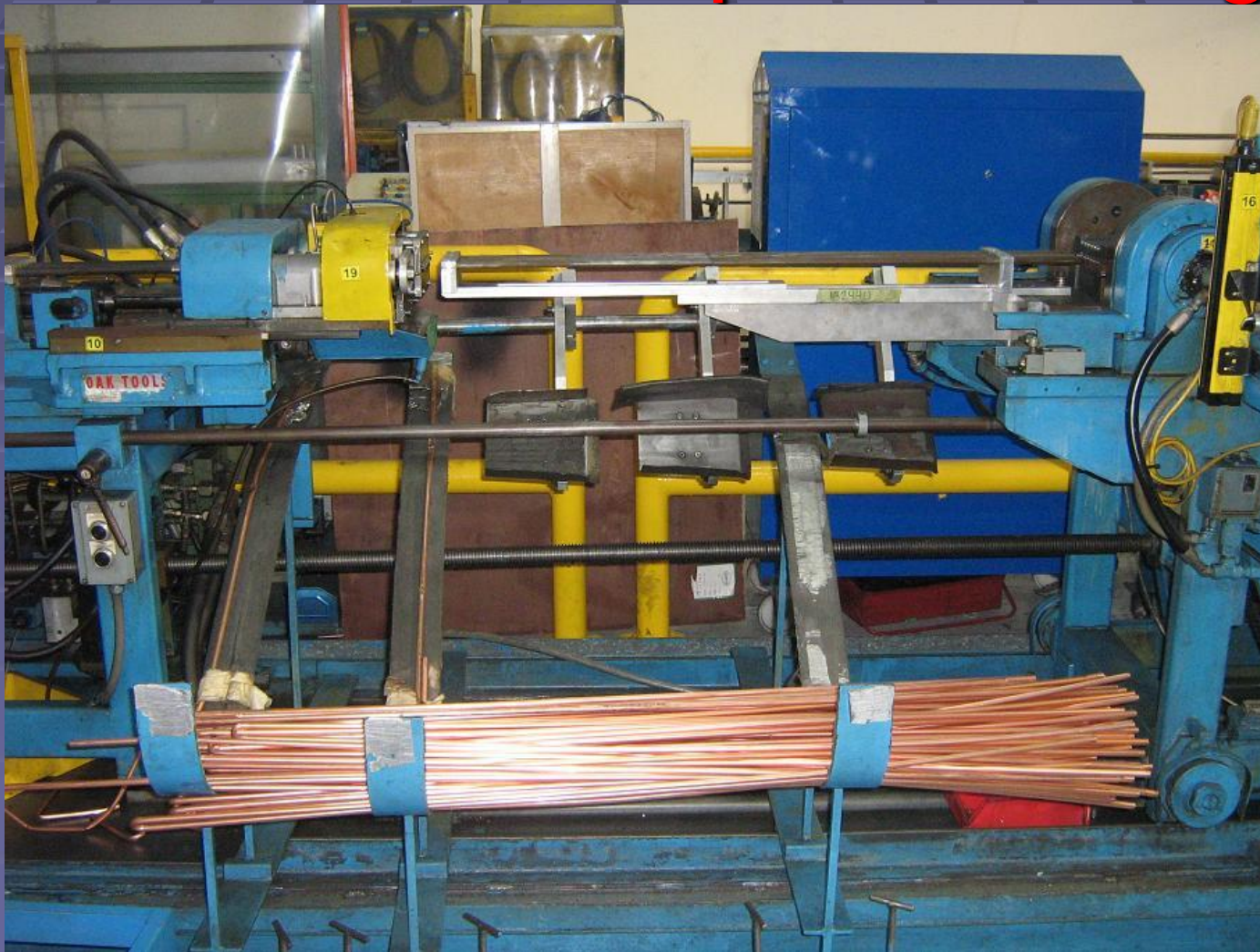




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Process of Hairpin Bending





Process of Hairpin Bending



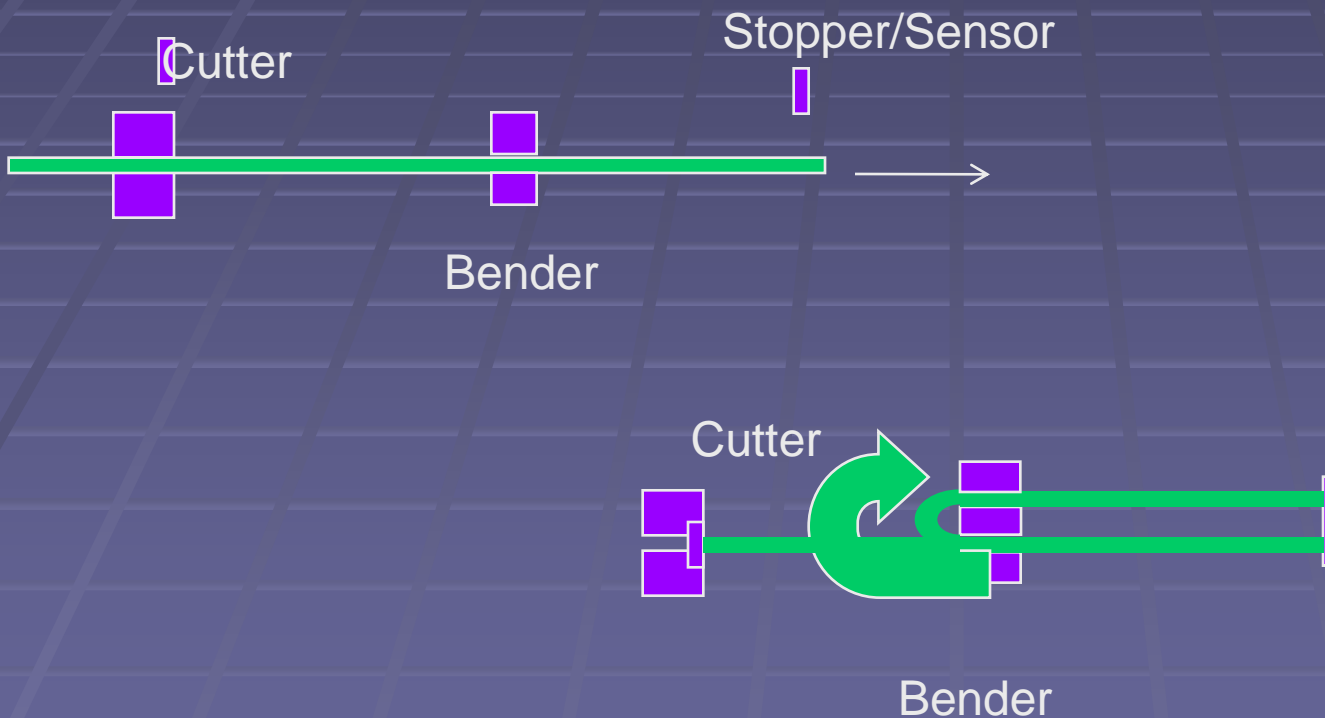


Process of Hairpin Bending





Process of Hairpin Bending





Process of Hairpin Bending





Lacing

- Process of inserting the U shape hairpin bending through the condenser fin
- Powered by man power process



Lacing





Lacing





Expanding

- Process of expanding the end edge mouth of the U shape hairpin bending tube to hold the metal plate
- Process through a highly accurate and efficient machine using expanding method.



Expanding





Expanding





Expanding





Expanding





Expanding





Expanding



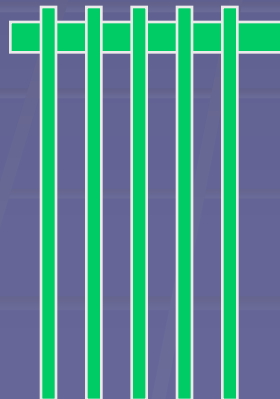
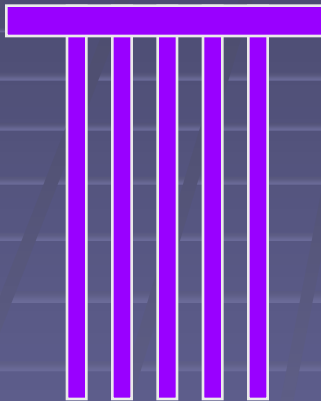


Expanding





Expanding





Insert Return Bend

- Process of inserting the U shape hairpin bending
- Powered by man power process



Insert Return Bend





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Insert Return Bend





Brazing Return Bend





Brazing Return Bend





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Pressure Decay Leak Test





Helium Leak Test





Helium Leak Test





Nitrogen Charging





Degreasing





Degreasing





Rinsing



Drying





Packing





Packing





Packing





Packing





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Shipping





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Advantages of Advance Manufacturing



Advantages of Advance Manufacturing

- ❖ Increase in production Rate
- ❖ Lower manufacturing lead times
- ❖ Greater flexibility in production scheduling
- ❖ Increase in consistency and accuracy of process plans
- ❖ Reduction in reliance on skills of planning engineer



Conclusion

- Advance machining system in Carrier keep them in a high production rate.
- The advance machining system is actually combination of few basic concept with the integration of the automation.
- Combination of basic concept can output a new machining concept which improve the overall process.