

# 埃马克机床的 精益之旅

## LEAN PROCESS AT EMAG CHINA

埃马克(中国)机械有限公司 | EMAG China Ltd.

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埃马克(中国)机械有限公司 首席执行官

CEO EMAG China

埃马克集团 模块化标准型机床 产品总监

Director Modular Standard Machines EMAG GmbH + Co. KG



1 埃马克介绍 | Introduction of EMAG

2 „精益“的含义是什么 | What is the meaning of „Lean“

3 节拍式装配 | Assembling in tacts

4 节拍式钣金生产 | Sheet metal production in tacts

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Turning



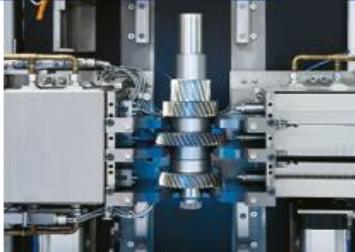
Milling



Grinding



Gear Hobbing



Heat Shrink Assembly



ECM/PECM



Laser Welding



Inductive Hardening



## Key figures for the EMAG Group in 2016 | 埃马克集团2016年关键数据

Turnover 营业额	Export share 出口份额	Workforce 员工人数	Apprentices 培训生	Technology companies 技术公司数量	Manufacturing companies 生产公司数量	Market companies, branch establishments, sales + service 市场公司, 分公司, 销售+服务
550 Million €	64 %	2,639	149	6	2	25

## THE EMAG GROUP TODAY 今日的埃马克集团

Over 超过

- **11,700 EMAG pick-up turning machines, turning centers and multi-functional production centers,**  
11,700 埃马克立式机床，车削中心以及多功能生产中心
- **4,150 grinding machines from REINECKER, KARSTENS, KOPP and NAXOS-UNION and almost**  
4,150 来自REINECKER, KARSTENS, KOPP以及NAXOS-UNION 的磨床
- **2,250 machines from KOEPEL for the machining of gears, have been built since the beginning of the 90s and**  
**are now in use in many branches of industry across the globe.**  
几乎2,250来自KOEPEL的机床，用于齿轮加工，建于90年代初，如今用于全球多个工业行业



Technology Companies 技术公司	Production Companies 生产公司	Market Companies 市场公司
<b>EMAG Maschinenfabrik GmbH</b> Technologie Center for EMAG-, Reinecker-, Karstens-, Kopp and Naxos Union-Products Salach	<b>Werkzeugmaschinenfabrik</b> <b>Zerbst GmbH</b> Zerbst	<b>EMAG Salach GmbH, Salach</b> Sales and Service
<b>EMAG KOEPPFER GmbH</b> Villingen-Schwenningen	<b>EMAG (China) Machinery Co. Ltd.</b> Jintan	<b>Sales and service offices</b> Frankfurt Leipzig Munich Austria Denmark Sweden Poland Czech Republic Hungary
<b>EMAG Automation GmbH</b> Technologie Center for Laser Systems Heubach	<b>EMAG Automation GmbH</b> Automation and Workholding Technology Heubach	<b>EMAG UK</b> Wolverhampton, GB
<b>EMAG Leipzig</b> Technologie Center for Oilfield Components Leipzig		<b>EMAG NODIER France</b> Paris, La Guerche
<b>EMAG ECM GmbH</b> Technologie Center for ECM / PECM Gaeldorf		<b>EMAG Zeta Italy</b> Milan
<b>EMAG eldec Induction GmbH</b> Technologie Center for Inductive Hardening Dornstetten		<b>EMAG Spain</b> Barcelona
		<b>EMAG OOO</b> Moskau, RF Belarus
		<b>EMAG China, Taicang</b> <b>EMAG China, Chongqing</b> <b>EMAG Korea, Seoul</b> <b>EMAG Thailand</b> Chonburi
		<b>EMAG TAKAMAZ Japan</b> , Ishikawa
		<b>EMAG India</b> Bangalore
		<b>EMAG USA</b> Farmington Hills
		<b>EMAG Mexico</b> Mexico City
		<b>EMAG Brazil</b> Sao Paulo

- Production started in April 2014

2014年4月投产

- Location: Jintan, Jiangsu

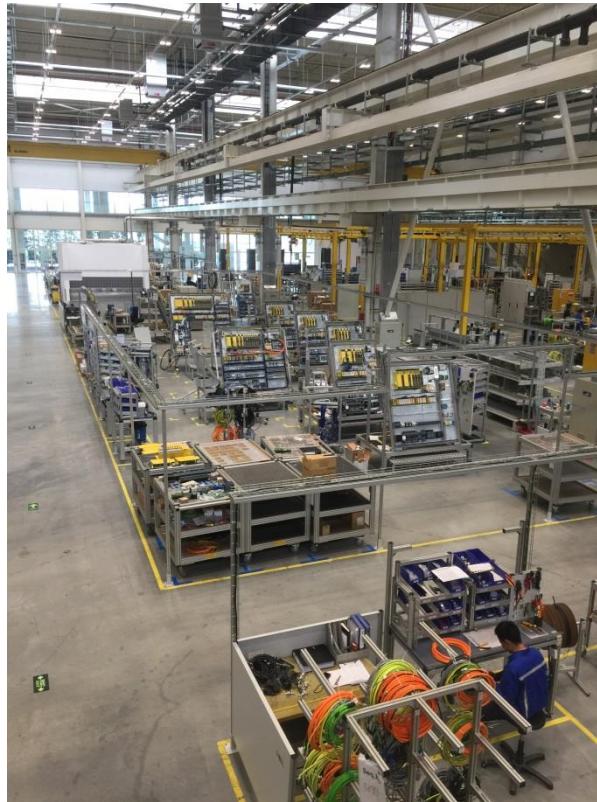
地点: 江苏省常州金坛

- Floor area of approx. 50,000 m<sup>2</sup>

面积约占50,000平方米

- 500 employees

约500名员工



**Sub Assembly 部装**



**Final Assembly 总装**



Office Area 办公区



Machining 机加工区



Show Room 展厅



Sheet Metal 钣金区

■ Sales 销售

■ Technology 技术

■ Engineering 工程

■ Commissioning 调试

■ Service 服务

■ Retrofit 翻新

■ Training 培训

■ Marketing 市场



## Training 培训

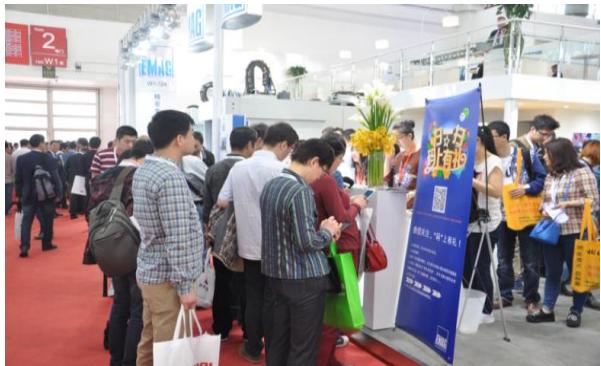


- **Language Training 语言培训**
- **Sales Training 销售培训**
- **CAMOS Training CAMOS培训**
- **CAD Training CAD培训**
- **UG Training UG培训**
- **SAP Training SAP培训**
- **Service Training 服务培训**
- **Customer Training 客户培训**
- ....



## Marketing 市场

### Exhibition 展会



### Media Conference 多媒体会议



### Customer VIP Tour VIP客户参观



### Open Days 开放日



**GRAND OPENING : 21.10.2016**

**开幕仪式: 21.10.2016**

- Yongchuan, Chongqing 地点: 重庆永川
  - Established 2015 成立于2015年
  - Production floor 5.000m<sup>2</sup> 生产占地约5,000平米
  - Office floor 1.000m<sup>2</sup> 办公室占地约1,000平米





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一切不服务于价值创造的工作都是浪费。

亨利·福特

EVERYTHING WHICH DOES  
NOT SERVE FOR THE  
CREATION OF VALUE IS  
WASTE.

*Henry Ford*



只有从客户的角度来看，增加产品附加价值的活动才是增值活动。其他一切都是浪费。Only activities which increase the value from the customer's point of view are added values. Everything else is waste.

## 增值活动的定义 | Definition of added value:

增值活动 = 从客户的角度来看，提高产品价值的活动才是增值活动 | Added value = all operations which increase the value of the product from the customer's point of view.

客户只会付钱给增值活动  
Added value is what the customer is prepared to pay for.

浪费的定义：(日本语: Muda)  
Definition of waste (Japanese: Muda):

浪费 = 所有的非增值活动 | Waste = All operations which do not increase the value of the product from the customer's point of view.

- 浪费使成本增加，从而降低竞争力。
- 浪费，首先必须进行识别和区分，然后进行减少或消除。
- Waste results in increased costs and thus in the loss of competitiveness in the long run
- Waste must first be identified and accepted in order to reduce and/or eliminate it

过量生产 = 生产出在当下时间点不需要的产品。

Overproduction = production of parts which are not needed at the current point in time.

## 过量生产... | Overproduction...

- … 导致其他浪费; | causes other types of waste;
- … 导致其他浪费更明显; | makes other types of waste visible;
- … 减缓快速处理事务的能力; | blocks capacities and thus slows down the ability to react to changes;
- … 增加质量风险; | incorporates a quality risk;
- … 增加生产周期; | increases lead time;
- … 是由于错误的安全库存方式所导致的; | is the result of a false belief that stock creates safety;
- … 是由于过长的制程时间所导致的. | is caused by long set-up times.

明显的浪费 → 必须消除 | OBVIOUS WASTE → MUST BE ELIMINATED

## 不必要的工作 = 生产流程中不必要的动作

Movement = movement which is not necessary to complete the production process.

### 不必要的工作... | Unnecessary movements ...

- ... 增加员工工作难度; | are a sign of high handling efforts;
- ... 延长时间; | cause delay;
- ... 增加员工疲劳程度, 绩效降低 | result in physical stress, exhaustion and deterioration of performance.

一般来说, 80%的动作都是浪费, 因此减少员工非增值的动作可以提高效率。 |

Typically 80% of the movements of a worker are waste.

Thus, the minimization of movements offers a huge potential for improvement.

潜在的浪费 → 必须减少 | Hidden waste → must be reduced

理想的低浪费的生产方式是在持续的工序链中实现“一件流”。 | The ideal scenario in low waste production is ‘one-piece-flow’ with as continuous, uninterrupted process chain.

一件流 = 生产的完成是基于在整个生产系统的工件流中没有任何中间缓冲或储存。

One-piece-flow = Production is accomplished on the basis of individual work pieces which flow through the whole production system without any intermediate storage or buffer.

产品不断地在生产流程中加工处理，直到它完成。在这个过程中，工件不断从前一个工序移动到下一个工序没有中断。一件产品结束后，另一件产品接着进行加工。

Just one part is continuously processed within the production flow until it is finished. In this process, the work piece continuously moves directly from one working station to the next without interruption, and respectively, one operation after the other is performed on the stationary work piece.

理想的生产方式是连续的单件流。在半成品到完成品中无中断。 | The ideal process to aim at is a continuous one-piece-flow without interruptions from the semi-finished product to the finished product.

## 1. 可靠性 | Disturbance free

- 可靠的流程是其余三个特征的基础。  
**Solid processes form the basis for the three remaining characteristics**
- 差错被迅速解决。  
**Defects are immediately removed**
- 清洁和整齐是可靠流程的基础。  
**Orderliness & tidiness form the basis for solid processes**

## 4. 拉动 (拉动生产) | Pull (pulling production)

- 拉动原则在所有 保留的界面上得到运用。  
**The pull principle is applied at the remaining interfaces**
- 物料供应的控制权 绝大多数由生产部门负责。  
**The responsibility for controlling material supply is mostly transferred to the production sector**

## 2. 流动 | Flow

- 最理想的是从原材料到完成品的一件流。  
**The ideal is a continuous one-piece-flow from raw materials to finished goods**
- 连续流要求最短的传递周期时间，保持最可能少的物品。  
**The continuous flow with the lowest possible amount of goods to be forwarded minimizes lead time**

## 3. 节奏 | Rhythm

- 平直、均衡的生产是基于稳定的节奏进行的。  
**Levelled out production is the basis of a smooth production rhythm**
- 客户需求决定了工作周期。  
**The customer determines the takt time**
- 预防浪费的标准化工作。  
**Standardised work prevents waste**

精益生产的四个特征 |  
The Four Characteristics  
of Lean Production.



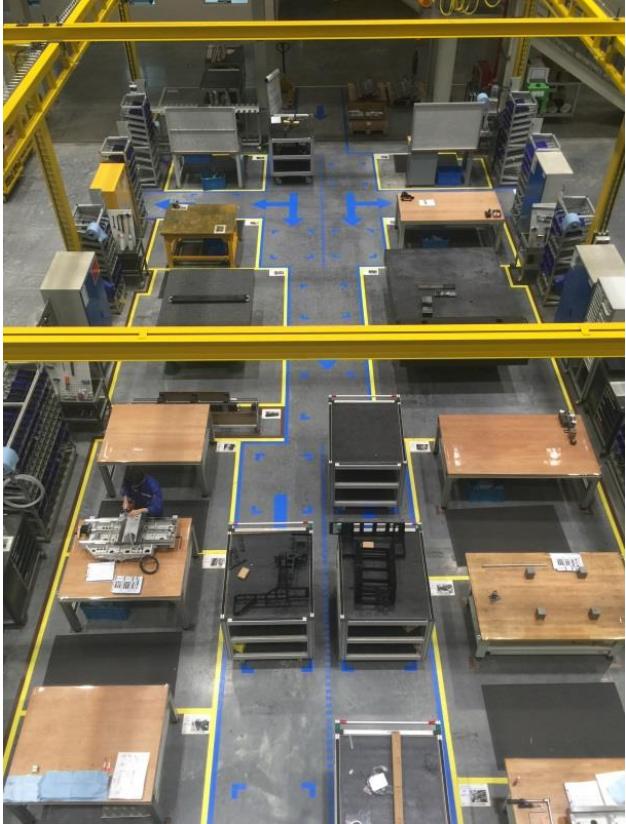
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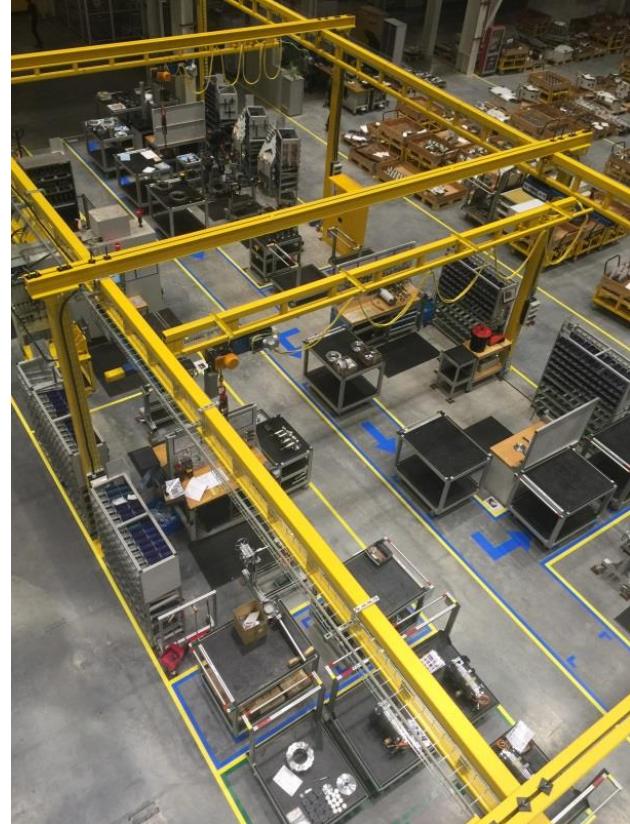
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导轨滑台单元 | Segment sliders



刀塔单元 | Segment turrets



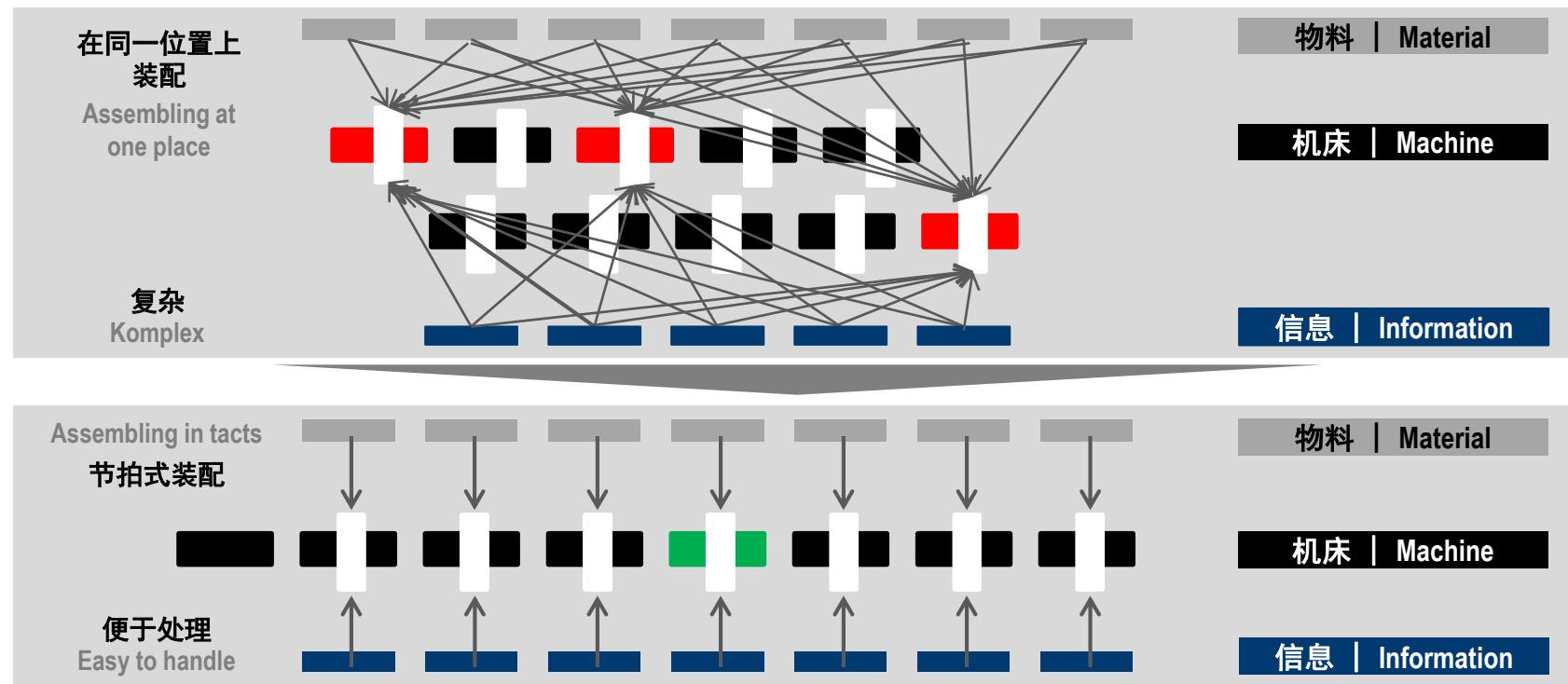
## 预装配 | Preassembling



## 最终装配 | Final assembling



对比: 在同一位置上装配 vs. 节拍式装配 | Comparison: Assembling at one place vs. Assembling in tacts

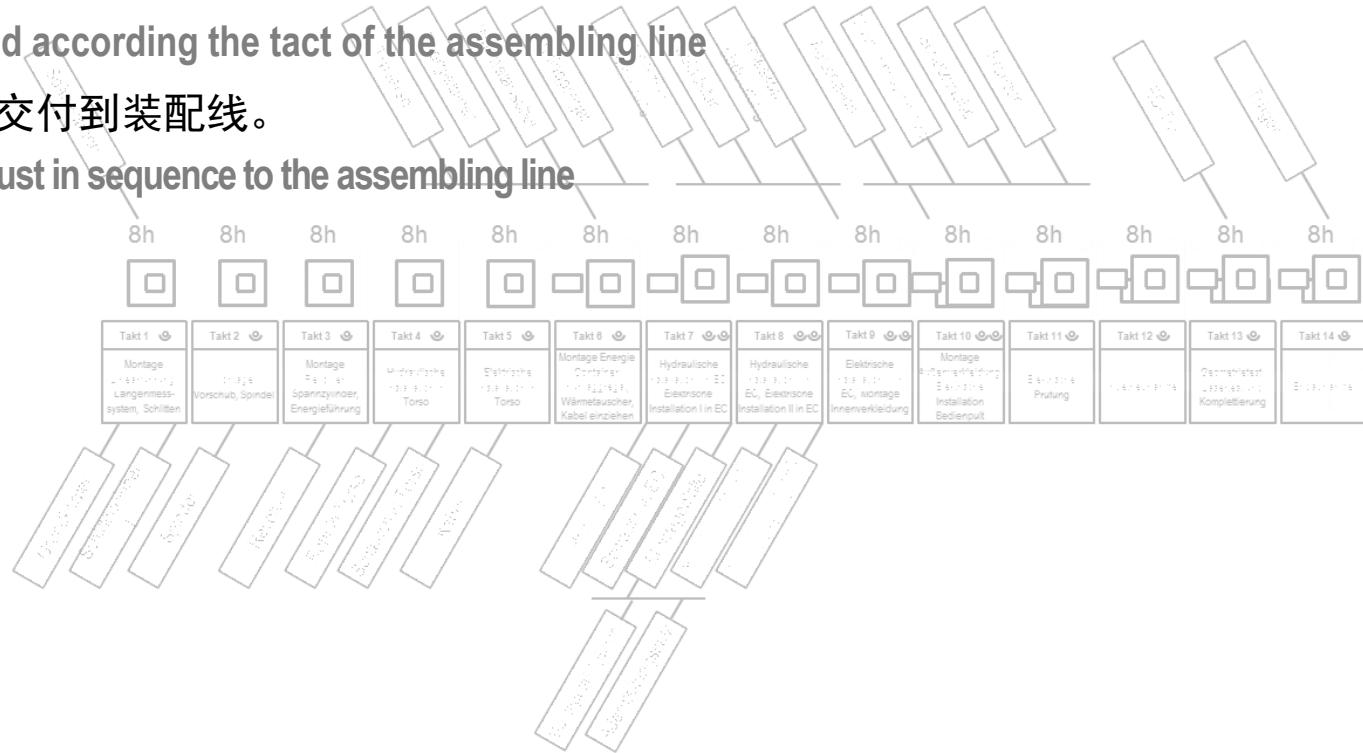


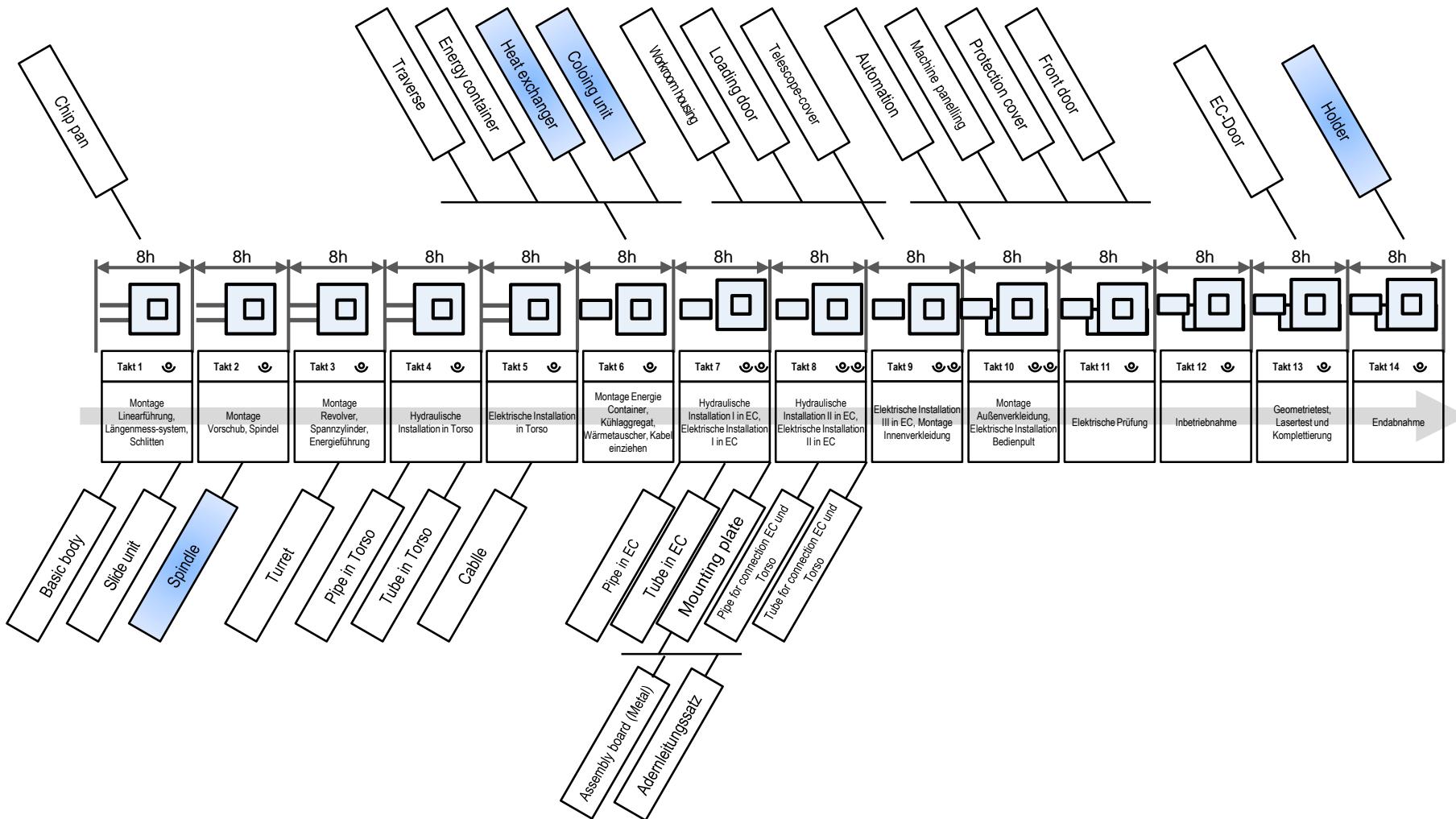
- 所有零件都根据装配线的节拍进行生产

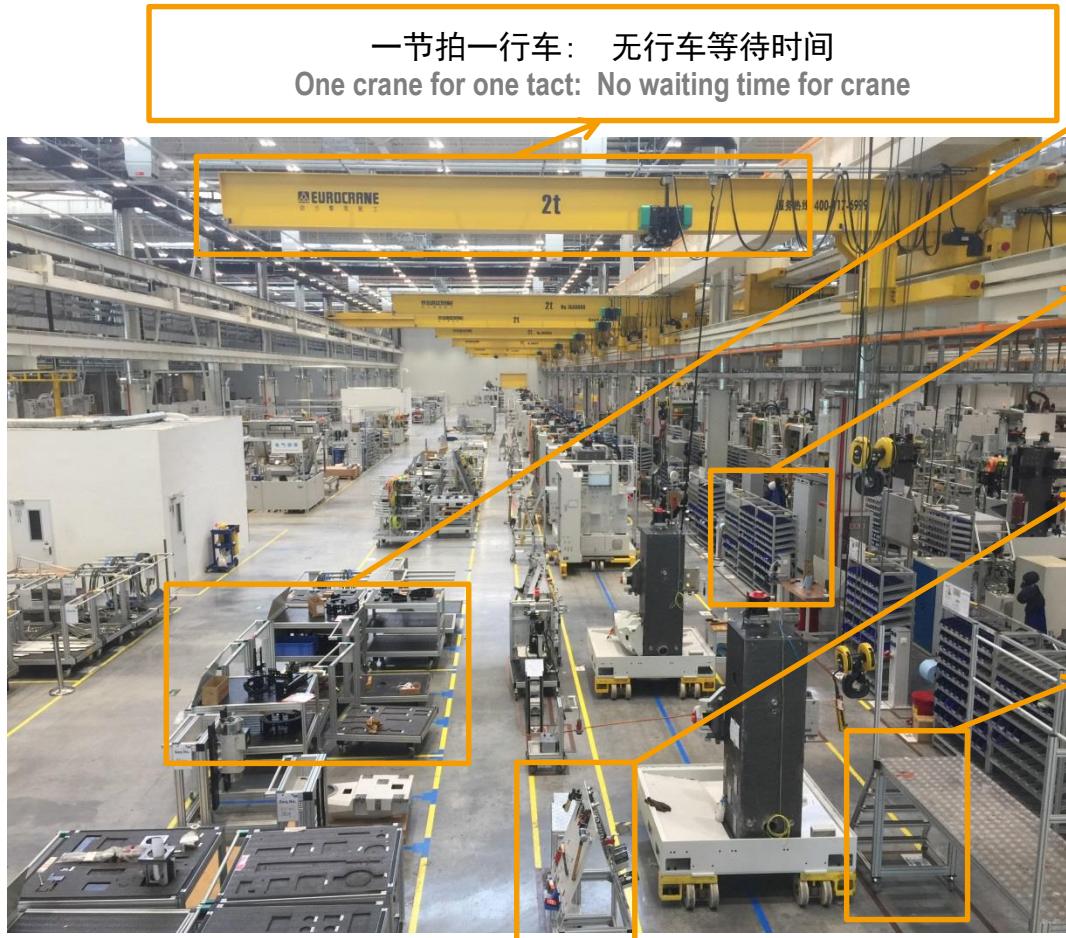
All parts are produced according the tact of the assembling line

- 所有零件依次按序交付到装配线。

All parts are delivered just in sequence to the assembling line







一节拍一行车：无行车等待时间  
One crane for one tact: No waiting time for crane

在节拍上进行物料交付：无寻找时间，最优化提供  
Material delivery at the tact:  
No searching time, Best Point providing

在任何节拍你都可以找到C类件：  
无寻找时间，最优化提供  
At any tact you will find C-parts:  
No searching time, BestPoint-providing

节拍上有各类所需工具工装：无寻找时间，最优化提供  
All necessary tools and fixtures at the tact:  
No searching time, Best Point providing

节拍上有各类所需设备：无寻找时间，最优化提供  
All necessary devices at the tact:  
No searching time, Best Point providing



只给予节拍所需要的工具盒零件。 | Only the tools and the parts, which are required by the tact, are available

- + 减少浪费 | Reduction of wast
- + 提高效率 | Increase of efficency



## 使用特殊料架供给 | Supply by special racks

- 改善分配  
Increase of efficiency
- 给出特定装配顺序  
Gives a certain assembling sequence
- 降低成本  
Reduces the costs

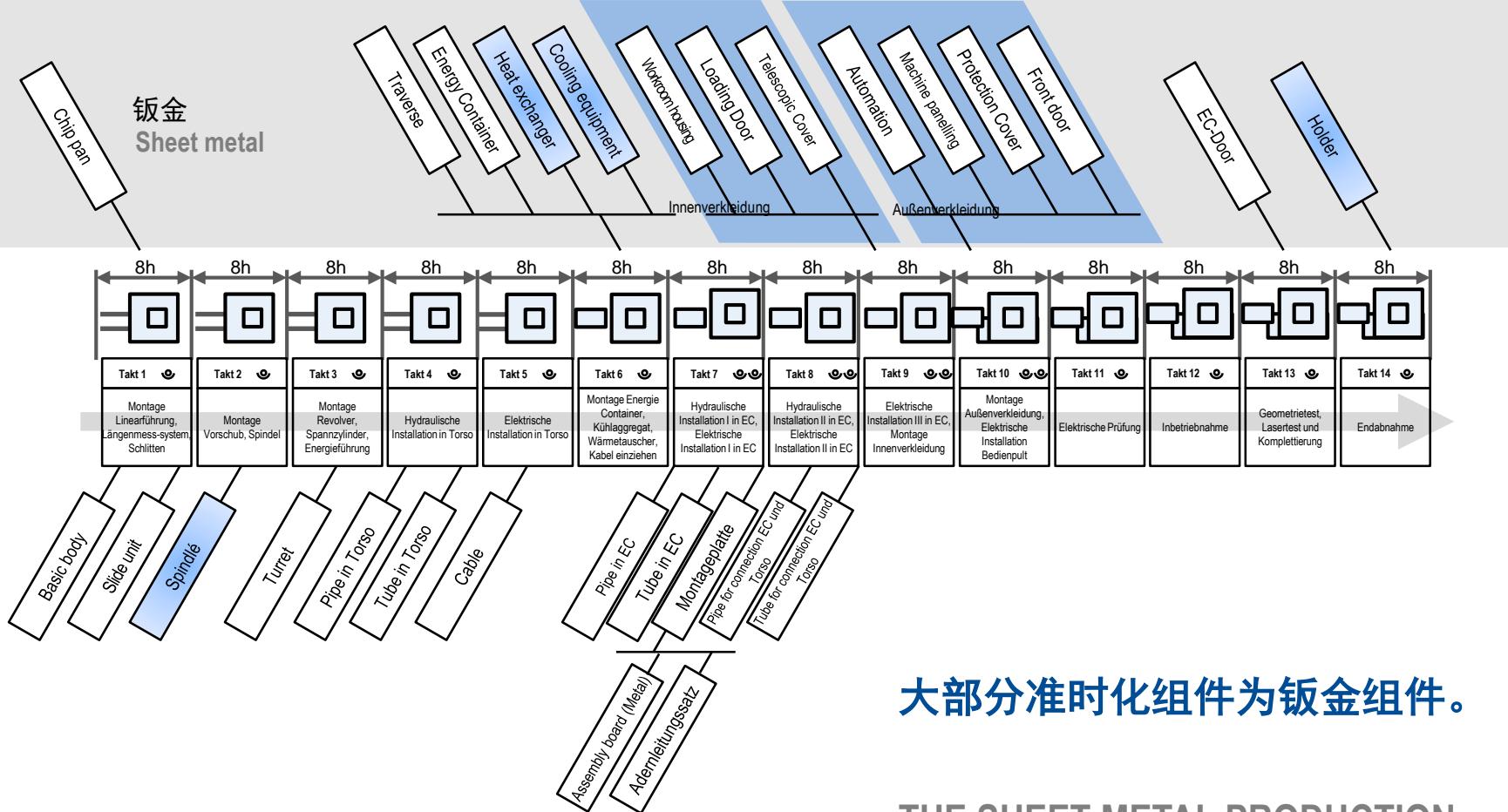
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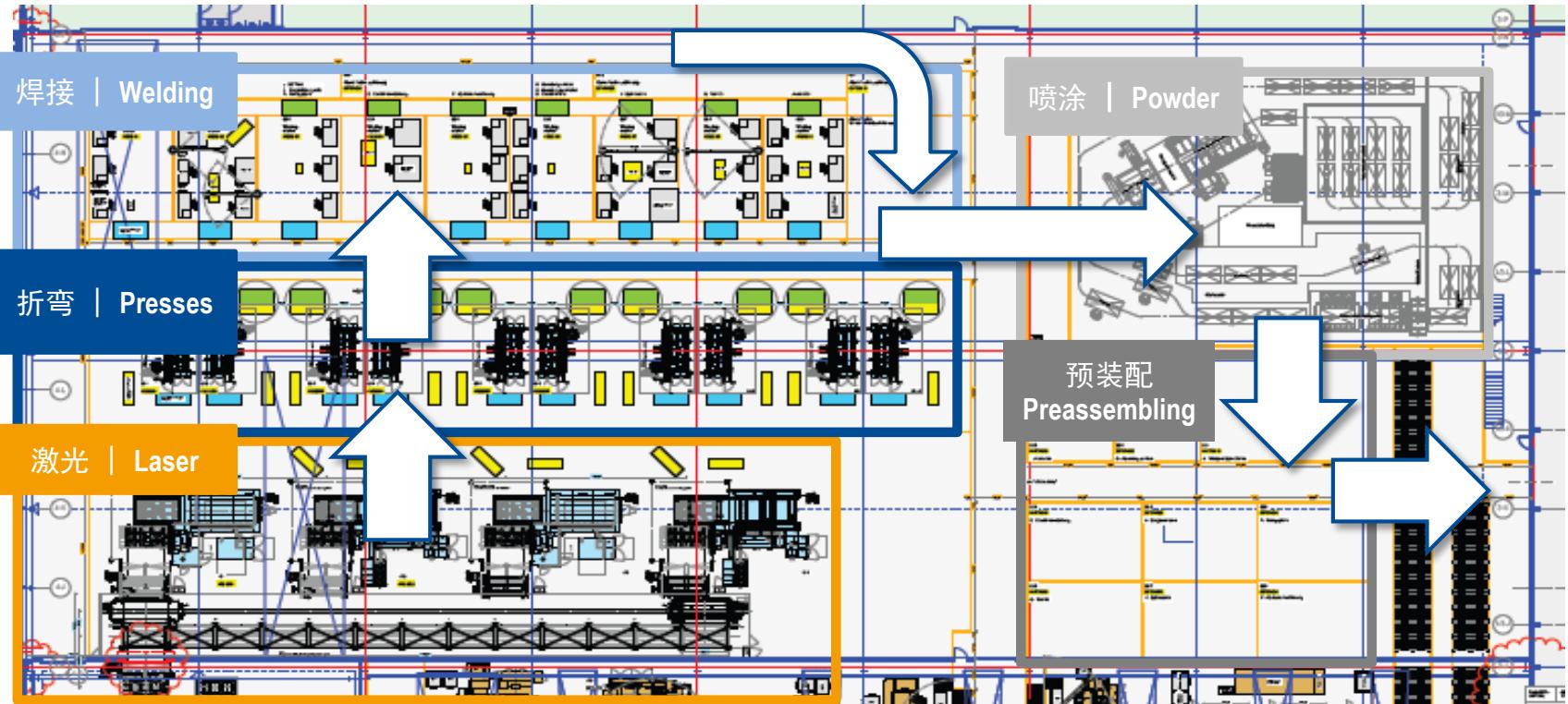
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大部分准时化组件为钣金组件。

THE SHEET METAL PRODUCTION  
DELIVERS MOST OF THE „JUST IN  
SEQUENCE“ MODULES



根据订单进行模块生产，并将其相应的提供到装配线。

THE MODULES WILL BE PRODUCED ACCORDING ORDERS AND  
WILL BE SUPPLYED TO THE ASSEMBLING LINE ACCORDINGLY

节拍 | Tact 6



预装配 | Preassembling

粉末喷涂 | Powder Coating

焊接 | Welding

折弯 | Bending

激光 | Lasering

每个钣金模块的工序及相应的提前期都类似但不相同。

The process steps and  
accordingly the lead time  
of any sheet metal modul  
is similar but not equal

在同一个生产节拍上，我们生产给6台不同机床的一套钣金模块

IN ANY PRODUCTION TACT WE PRODUCE ONE SHEET METAL MODUL, FOR 6 DIFFERENT MACHINES

用于机器100的 生产启动节拍 Production tact for machine 100															“机器 100” 装配开始 Assembling start of Machine 100“											
生产计划   Production planing															装配线   Assembling line											
	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	1	2	3	4	5	6	7	9	10	11	12	13	14
接屑盘   Chip pan	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	1												
装配板   Assembling panel	95	96	97	98	99	-8	-7	-6	-5	-4	-3	-2	-1	1	2											
电气柜支架   Traverse	93	94	95	96	97	98	99	-6	-5	-4	-3	-2	-1	1	2	3	4	5	6							
电气柜   Energiecontainer	95	96	97	98	99	-8	-7	-6	-5	-4	-3	-2	-1	1	2	3	4	5	6							
加工区钣金   Cover of working space	90	91	92	93	94	95	96	97	98	99	-3	-2	-1	1	2	3	4	5	6	7	9					
伸缩护罩   Telescopic cover	88	89	90	91	92	93	94	95	96	97	98	99	-1	1	2	3	4	5	6	7	9					
机床外罩   Housing of machine	91	92	93	94	95	96	97	98	99	-4	-3	-2	-1	1	2	3	4	5	6	7	9	10				
电气柜门   Door	88	89	90	91	92	93	94	95	96	97	98	99	-1	1	2	3	4	5	6	7	9	10	11	12	13	

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